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How optically flat reflective sheeting keeps entire sign visible in any weather

With the ever-growing volume of traffic on city streets, it is increasingly important that signs function at their highest level at all times. This is especially true at night and in bad weather when the need for visibility is greatest.

Nighttime visibility of traffic signs through reflectivity has been an accepted fact for quite some time. But weather remains an enemy of most traffic signs . . . even reflective ones. That conditions of rain, snow, fog and the like curtail visibility is no secret. The "fair weather" sign, even under such conditions as a heavy dew, loses as much as 95% of its reflective quality.

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No blackout in water

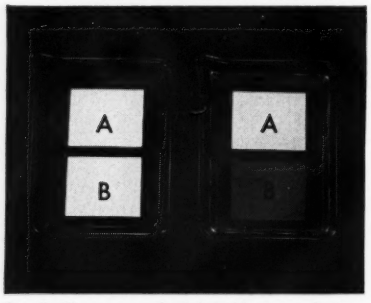

Fig. 1. The pan on the left holds two reflective samples. "A" is optically flat "Scotchlite" Sheeting; "B" is an exposed lens material. When dry, both reflect. In the pan on the right, one inch of water covers both samples. While "Scotchlite" Sheeting loses little of its designed reflectivity, sample "B," with its optical characteristics changed, "blacks out."

"Scotchlite" Reflective Sheeting, as you may know, is a reflex-reflector. It directs collected light from an approaching auto headlight right back to its source. An entire sign of this material reflects the full message of that sign—the true shape, color and legend. Because of the optically flat surface of the sign, its designed reflective characteristics are retained with a minimum loss of efficiency and performance in a heavy rainfall. Motorists can still see the entire sign clearly.

Where reflective elements are exposed, however, water fills in and alters the optical focus, causing a severe loss in reflection. The photo in Fig. 1 demonstrates this point.

Shown are two pieces of reflective material. That labelled "A" is optically flat "Scotchlite" Sheeting. "B" is exposed lens sign material. In the first picture, both are dry, both reflective. In the second, both have been placed *under water*. You can see how the sample of "Scotchlite" Sheeting continues to reflect to a high degree while the other, sample "B," has blacked out. Here is positive proof that "Scotchlite" Sheeting succeeds in communicating when exposed lens systems fail.

* * *

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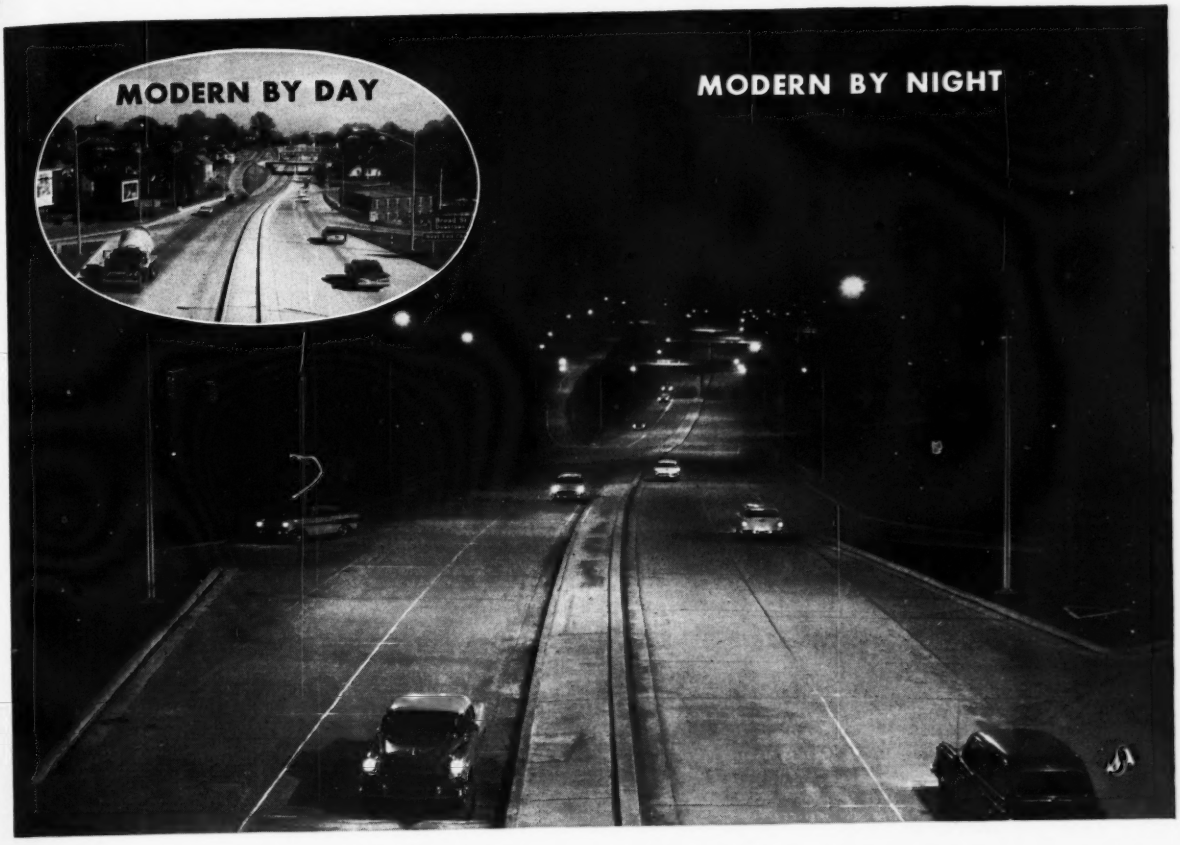
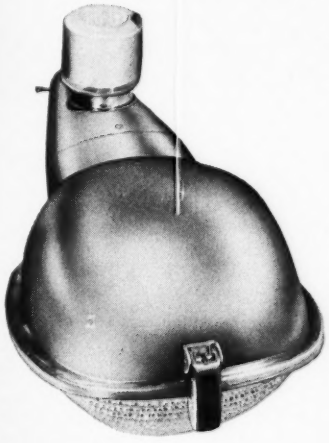


Modern light on Winston-Salem Interstate link makes nighttime driving as safe as daytime



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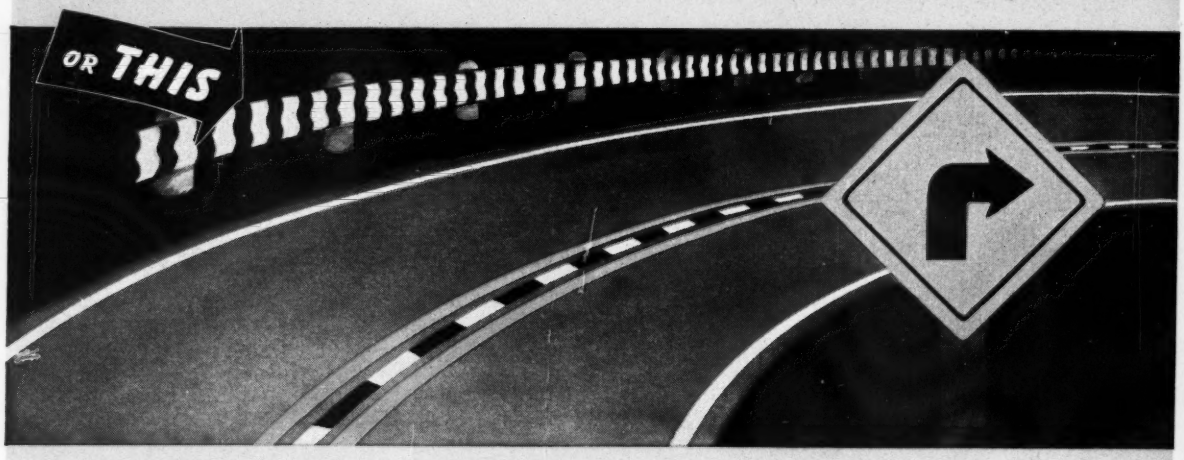

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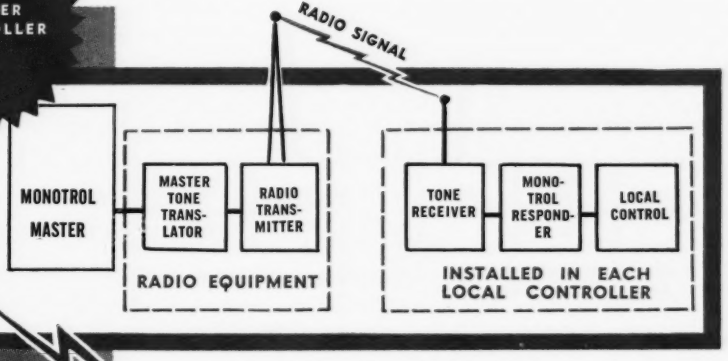

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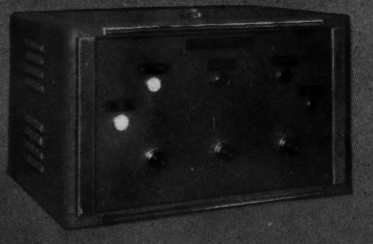

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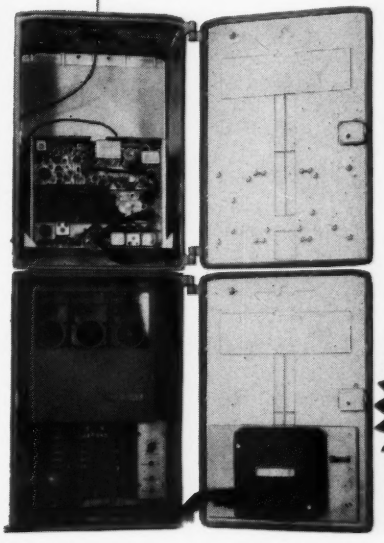

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COVER: Sign erected on Ohio Turnpike on slight up-grade, sufficient to slow heavy vehicles. The sign reduced accidents.

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Frankly Speaking . . .

PROFESSIONAL PRESTIGE is a standing in the community desired by all traffic engineers, but it is a status that is earned on more fronts than technical ability alone.

It is a status conferred by the community, in part due to its recognition of the individual and in part due to the recognition of the profession. The esteem that is bestowed upon one traffic engineer reflects upon the profession as a whole and the esteem thus gained by the profession in turn adds to the prestige of traffic engineers in other parts of the country.

The individual traffic engineer and particularly the individual member of ITE therefore is as important to the development of the professional prestige of traffic engineering as is the national organization, the section and the area groups of ITE.

Technical proficiency of the individual or the organization alone will not advance the professional prestige of traffic engineers. To obtain this prestige the proficiency of the traffic engineer must be recognized and must be wanted; and of all the professions that of traffic engineering is perhaps the one profession that has the greatest odds against it. These very odds, however, can be turned and when turned will be just as favorable as they were unfavorable.

What are these unfavorable odds and how can they be turned? The odds to be overcome are the feelings and beliefs of all citizens and particularly other professional people that their every day experiences in and with traffic qualify them to judge traffic engineering problems and prescribe solutions. These odds we all recognize. But what we often do not recognize is that the unwillingness on the part of the public to abandon their judgment in favor of that of the traffic engineer is lack of confidence—not lack of confidence in technical ability as a rule but in the traffic engineer's understanding and desire to solve their personal traffic problems.

The development of public confidence that the traffic engineer does understand and is sincerely interested in their personal problems can only be obtained by effort and sacrifice on the part of the traffic engineer and the profession as a whole.

This can best be accomplished by participation in community projects where the engineer proves his interest in affairs other than traffic. With the individual engineer the path lies in the direction of the church, the school, the service club and particularly, accepting leadership in worthwhile city-wide activities not predominately involved with traffic. With the organization, it means contributing group time and effort to the advancement of other organizations with mutual interests not predominately traffic.

The recent application of the San Diego Area ITE group for membership in the San Diego Engineering Council can be pointed to as an ideal illustration. Other area groups would do well to follow this example and it is hoped that San Diego Area can find ways and means of enlarging their participation in activities outside of technical traffic engineering.

ROSS T. SHOAF
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Research to Improve Tomorrow's Traffic

By O. K. Normann
(Member, ITE)
Deputy Assistant Commissioner for Research
U.S. Bureau of Public Roads, Washington, D.C.

This paper was prepared in response to the 1957 Theodore M. Matson Memorial Award. Parts of it were presented at the Twenty-seventh Annual Meeting of the Institute of Traffic Engineers, Detroit, Michigan, September 23, 1957.

THIS PAPER is presented as one result of a plan by the many friends of the late Theodore M. Matson to give continued recognition to the outstanding contributions made by him to the field of traffic engineering. Anyone who knew Ted Matson cannot help but feel humble on an occasion such as this, since his dynamic efforts were directed with such a marked success to many phases of traffic engineering. He was most widely known for his ability as a teacher and as an administrator. The outstanding trait which impressed many of us, however, was his constant search for new knowledge that would forward the science of traffic engineering. He was constantly striving to develop and encourage the development of new methods, new techniques, and improved equipment for conducting traffic research. These efforts have influenced much of the development that has taken place during the past 20 years and research is still being initiated on new projects to which he gave the original inspiration.

The largest road-building program in our history is now well under way and progressing on schedule at a gratifying rate. Improved and new operational skills will be required to insure the smooth, safe flow of expected traffic moving in greater volume and speed than ever before.

The National System of Interstate and Defense Highways, with full access control, will require new techniques for handling traffic through proper signing, marking and other controls to assure that freeways and existing facilities will function as an integrated highway system. It is through continued research in traffic control, driver behavior, highway geometry, and planning activities closely associated with highway development —such as land use—that the greatest possible benefits, both economic and social, can be realized.

Speed Trends

One of the basic items of information needed for highway design and traffic control is the speed at which drivers operate their vehicles under various highway and traffic conditions. Since the automobile became a common means of transportation, horsepower and speed capabilities of vehicles have increased from year to year. The most substantial increase took place in the change between the 1954 and 1955 models of most makes.

Figure 1 illustrates the increase in the speed potential of American stock cars prevalent on our highway systems. The notable increase in horsepower from 1954 to 1955 is not reflected in maximum speed. The average 1941 model was capable of a speed of 86 miles per hour, with a range of from 78 to 101 mph. The possible speed of the average 1955 model was 97 miles per hour, with some capable of about 110 mph. Stock car speeds are again maintaining their relative position with the vehicles used in the Memorial Day races on the Indianapolis Speedway as shown by Figure 2.

Vehicles are seldom operated at these high potential speeds on public highways. In 1941, the average passenger car speed during low traffic volumes on straight level sections of rural highways, then considered of modern design, was about 48 miles per hour. Today's vehicles, at the same locations and under the same highway and traffic conditions, average about 52 miles per hour, an increase of only four

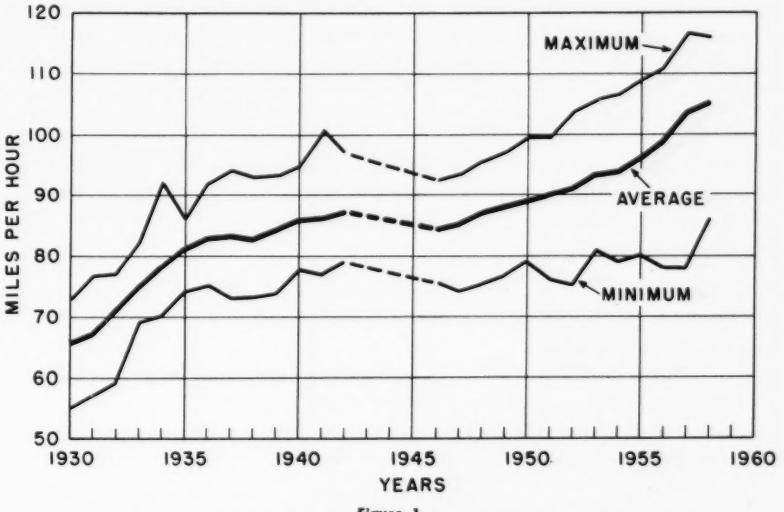

Figure 1
Trend of Maximum Car Speeds

Major parts of this paper were published in the "Traffic Quarterly" for July 1958. Mr. Normann has up-dated some of the charts for this printing, however, and the two versions are not identical.

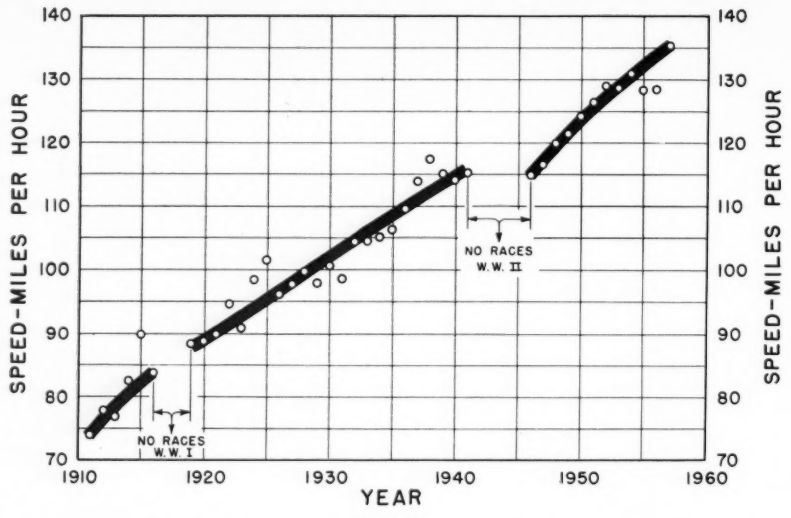

Figure 2
Average Speed of Winner in Memorial Day Races on Indianapolis Speedway

miles per hour over a sixteen-year period.

This four-mile-per-hour increase reflects the change in speed that has taken place with the change in vehicle design and driver behavior under unchanged highway conditions; it is based on periodic studies conducted at hundreds of locations throughout the country on some of the best roads available in 1941. Only those sections that have remained essentially unchanged have been restudied from year to year.

But speeds on modern highways today are considerably higher than on the best roads of 1941. In 1941, it was rare to find a location where the average speed was above 50 mph. Today, there are any number of locations where the average speed exceeds 55, and those with an average above 60 are now more common than those with an average above 50 in 1941.

The highest average speed recorded at any location to date has been about 64 miles per hour, with about 94 per cent of the vehicles exceeding 50 and nearly 25 per cent exceeding 70. This occurs within states that have a posted maximum of 60 mph as well as in states with no maximum limit.

The combined change in speed resulting from improved vehicle and highway design is illustrated by Figure 3. Four average speeds and the cumulative frequency distribution curve for each of these are shown. The results of nearly all speed studies conducted on tangent sections of main rural highways in 1941 during low traffic densities fell between curve A and curve B.

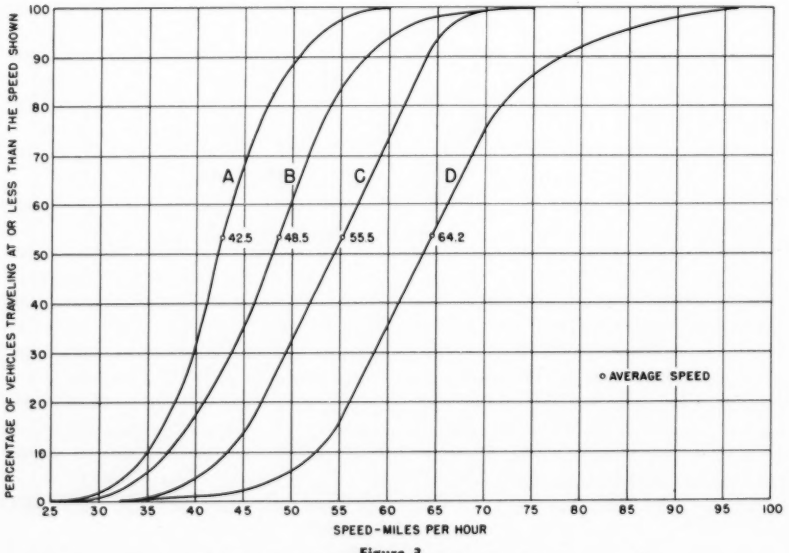

Figure 3
Distribution of Normal Passenger Car Speeds.

Speeds at the present time on modern rural highways generally fall between curve B and curve D of Figure 3. Curve B—which also represents the highest speed locations in 1941, including those with speed limits that were not enforced—is now exceeded on most modern highways except where a speed limit of 55 miles per hour, or less, is strictly enforced.

By comparing curves B and D, it will be noted that the top speeds have increased somewhat more than the lower speeds. The average difference of 16 miles per hour between curve B and D represents the change in driver behavior on rural highways through improved vehicle and highway design over a 16-year period on highways where drivers were not influenced by speed limit restrictions. This is an average increase of one mile per hour per year, or about 1.6 miles per hour per year since the return in 1947 after World War II to the 1941 level.

Information of this kind is needed for the design of future highways, for traffic control and other traffic regulations, and to keep pace with changing conditions so that useful trends can be established in the prediction of tomorrow's highway requirements. Just as important, are the effects that speed regulation and traffic volume or density have on travel speeds.

It is obvious that, without speed control, drivers on rural sections of roads comprising the interstate system will immediately, upon completion of route sections, travel at speeds indicated by curve D during low densities. It is also reasonable to believe that vehicle-speed capabilities can be improved in the future to at least the same extent as in the past, with the result that average speeds of 80 miles per hour and top speeds above 100 miles per hour will be common during low densities whereever there is no enforced speed control.

Speed-Volume Relations

Other important considerations will affect future travel speeds. These include speed-volume relations and the desirability or obvious need of enforced speed regulations. There are few highways where speeds are not

influenced by traffic density at some time; and in most areas, even on the most modern highways, speed limits are considered necessary to keep drivers within their performance abilities.

Curve C of Figure 3 shows a speed distribution typical of the most modern rural freeways having a well enforced 60-mile speed limit. The lowest speeds of this distribution are the same as those of Curve D representing present speeds at a location with no enforcement, whereas the top speeds are no higher than those of curve B representing a much lower average speed.

Regardless of improvements in highway design, it is apparent that enforcement of speed limits will be required to prevent drivers from exceeding safe speeds as determined by their physical abilities and the performance of their vehicles. This is necessary because vehicle-speed potentials continue to increase without a corresponding increase in other factors directly related to safety, such as friction coefficients and brake performance.

Since traffic volumes have increased at a much faster rate than it has been possible to construct new facilities, the percentage of time that highways are loaded to capacity or near-capacity volumes has increased. Speed-volume relations are therefore an increasingly important consideration in highway transportation, including their application to traffic regulation and enforcement as well as to the design of new highway facilities. Figures 4, 5, and 6 show the relation between speed and hourly traffic volumes on two-lane and multi-lane highways under present conditions at locations removed from the influence of intersections and heavy merging movements.

Figure 4 shows the speed-volume relations for two-lane highways without passing sight-distance restrictions. The operating speed, which is the highest over-all safe speed that drivers can travel under the prevailing traffic conditions, varies with the traffic volume and the highway speed. The highway speed, in fact, is the maximum safe over-all speed during low traffic volumes and varies with the stopping sight-distance, the sharpness and length of curves, and other geometric highway features.

From the curves of Figure 4 it may be seen that the ability of a good two-lane highway to accommodate traffic of today's desired speeds decreases rapidly with an increase in traffic volume. It is only at volumes under 700 passenger cars per hour for the total in both directions of travel that the faster drivers can average above 50 miles per hour on the better two-lane highways. For a safe operating speed of 60 mph, the total hourly volume cannot exceed 250 passenger cars per hour—a low volume indeed compared with the peak volumes that most of the nation's important highways must accommodate.

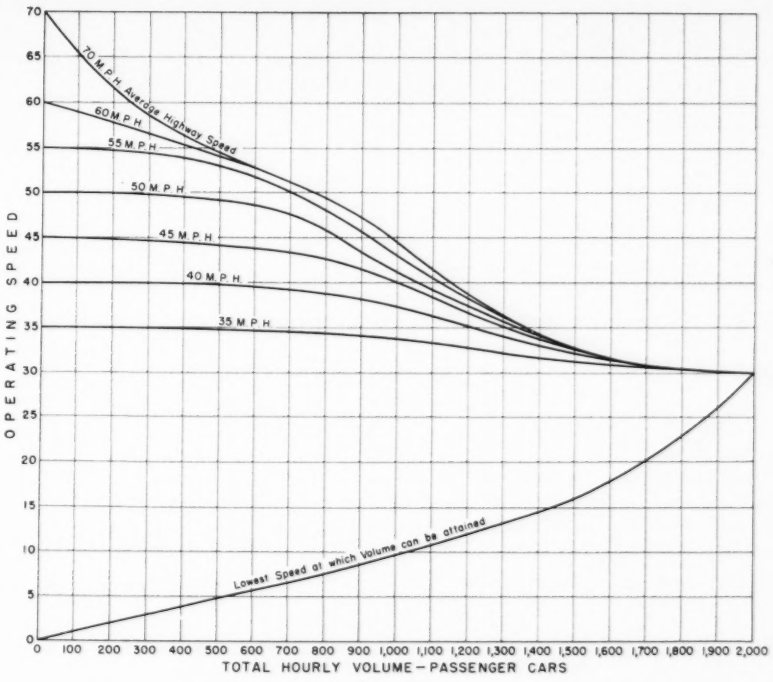
OPERATING SPEED
70 M.P.H. Average Highway Speed
60 M.P.H.
55 M.P.H.
50 M.P.H.
45 M.P.H.
40 M.P.H.
35 M.P.H.
Lowest Speed at which Volume can be attained
0 100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 1,500 1,600 1,700 1,800 1,900 2,000
TOTAL HOURLY VOLUME—PASSENGER CARS

Figure 4
Speed-Volume Relation for 2-Lane Highways

Multilane highways are therefore necessary to accommodate the heavier traffic volumes at reasonable operating speeds. Figures 5 and 6 show the speed-volume relation for four-lane divided highways. Figure 5 shows average speeds while Figure 6 shows operating speeds or maximum safe speeds for drivers who desire to travel as fast as possible.

The bottom curves of Figures 4, 5, and 6 show the minimum speeds to attain a particular traffic volume. For example, traffic in the heavier direction of travel on a four-lane highway must be moving at least 20 miles per hour to accommodate 3,400 vehicles per hour in the heavier direction (⅔ of 5,100).

The other solid lines of Figures 5 and 6 show the normal operating speeds and average speeds, respectively, under different traffic-volume conditions for various highway speeds.

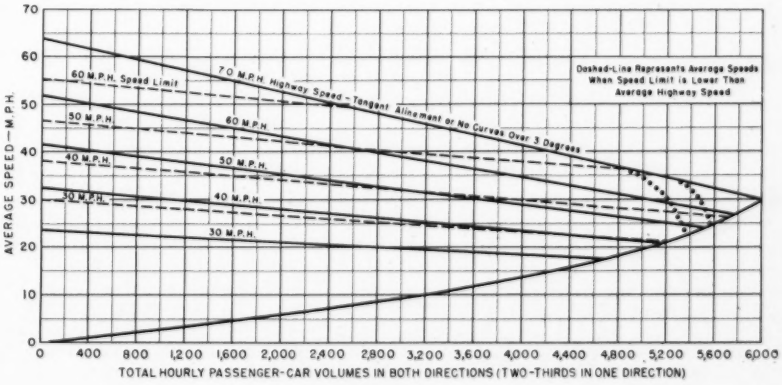
AVERAGE SPEED—M.P.H.
60 M.P.H. Speed Limit
70 M.P.H. Highway Speed - Tangent Alinement or No Curves Over 3 Degrees
50 M.P.H.
60 M.P.H.
40 M.P.H.
50 M.P.H.
30 M.P.H.
40 M.P.H.
30 M.P.H.
Dashed-Line Represents Average Speeds When Speed Limit is Lower Than Average Highway Speed
0 400 800 1,200 1,600 2,000 2,400 2,800 3,200 3,600 4,000 4,400 4,800 5,200 5,600 6,000
TOTAL HOURLY PASSENGER-CAR VOLUMES IN BOTH DIRECTIONS (TWO-THIRDS IN ONE DIRECTION)

Figure 5
Average Speeds for Heavier Direction of Travel on Four Lane Freeways

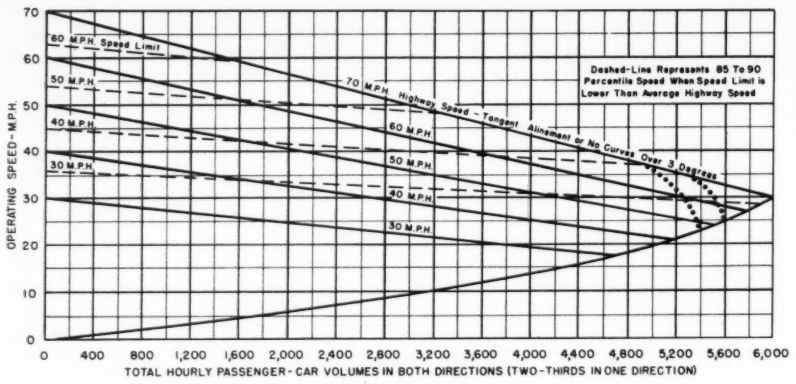
60 M.P.H. Speed Limit
50 M.P.H.
40 M.P.H.
30 M.P.H.
70 M.P.H. Highway Speed - Tangent Alinement or No Curves Over 3 Degrees
60 M.P.H.
50 M.P.H.
40 M.P.H.
30 M.P.H.
Dashed-Line Represents 85 To 90 Percentile Speed When Speed Limit is Lower Than Average Highway Speed
OPERATING SPEED - M.P.H.
0 10 20 30 40 50 60 70
0 400 800 1,200 1,600 2,000 2,400 2,800 3,200 3,600 4,000 4,400 4,800 5,200 5,600 6,000
TOTAL HOURLY PASSENGER-CAR VOLUMES IN BOTH DIRECTIONS (TWO-THIRDS IN ONE DIRECTION)

Figure 6
Operating Speeds for Heavier Direction of Travel on Four Lane Freeways

These curves are also applicable to six- and eight-lane divided highways because studies made to date indicate that in general the speed-volume relation per lane is the same for six- and eight-lane highways as for four-lane highways where entrance and exit facilities do not influence the speeds.

The dashed lines of Figures 5 and 6 show the effect of an enforced speed limit on the speed-volume relation. A speed limit has an effect on safe speeds only when it is lower than the highway speed. Also, it has an effect only when the traffic volume is below the volume at which the dashed speed limit line intersects the line corresponding to the highway speed. At the higher volumes, the solid lines show the normal speed-volume relations, since at these volumes the speeds are governed by traffic densities rather than by speed limits. For example, a 60 mph speed limit on a 70 mph divided four-lane highway would have no effect in the heavier direction of travel when the total volume exceeds 2,400 passenger cars per hour.

These speed-volume relations represent average conditions found on modern highways. In some areas, and under certain conditions, speeds are somewhat higher or lower than these charts indicate, but in general the differences are not great. Results of certain investigations show that on multilane highways only a very slight or no drop in speed occurs with an increase in volume.

This can be explained by the fact that a speed limit, or factors other than traffic density, exert a controlling influence on the speeds. When speeds increase with increased volume it is generally because the results are obtained from one particular location where the lighter volumes are recorded during off-peak periods and the heavier volumes during the rush-hour periods when a different group of drivers is involved, most of whom travel the same road each day. Several types of speed-volume curves can be obtained under these conditions of study since the true speed-volume relation is not recorded.

Another reason for obtaining a curvilinear line as the relation between speed and volume is the influence of the capacity "safety factor," as indicated by the distance between the upper and lower curves of Figures 5 and 6. This distance, which represents a possible speed range for a given volume, decreases rapidly as the volume approaches possible capacity. A slow driver or some other minor condition, interrupting the normal flow of traffic, can cause a sudden slowdown of all vehicles with the result that the speed-volume relation shifts from a point on one of the higher curves to a point on the bottom curve, or to any intermediate point. This is illustrated by the dotted lines on Figures 5 and 6. The closer the possible capacity is approached, the greater is the likelihood of such an occurrence.

Several factors other than highway speed and speed limit tend to affect the speed-volume relations. Those for which reasonably reliable data are available include the availability of passing-sections on two-lane roads, the width of traffic lanes, clearances to obstructions outside the traffic lanes, and the percentage of commerical vehicles. Their effects on operating speeds were included in the "Highway Capacity Manual" but some changes in the effect of these factors will be made in the revised edition.[1]

As an example, the manual suggests that truck equivalents of two, four, and eight be applied in level, rolling, and mountainous terrain for multilane highways and that these equivalents be increased 25 per cent for two-lane roads. More recent information shows that the truck equivalents on two-lane roads vary with the difference between the normal passenger car and truck speeds.

Figure 7 shows the variation in equivalents with truck speed for a

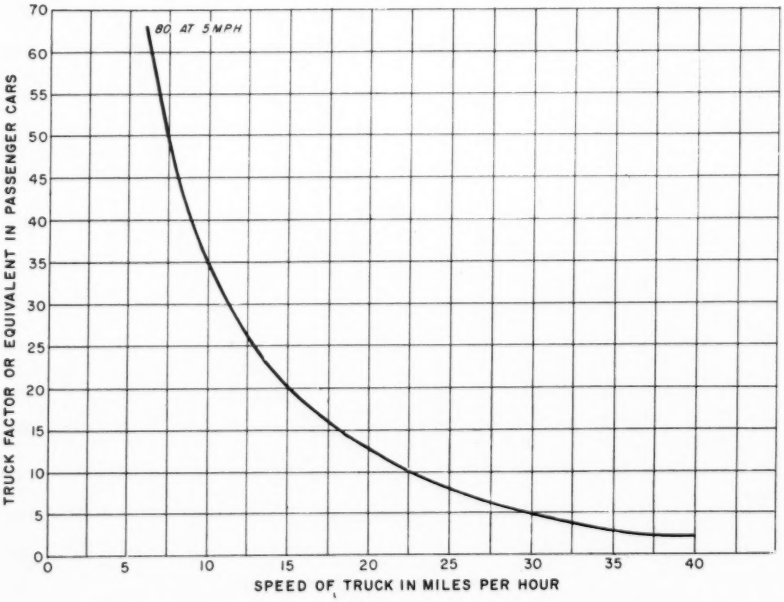
80 AT 5 MPH
TRUCK FACTOR OR EQUIVALENT IN PASSENGER CARS
0 5 10 15 20 25 30 35 40 45 50 55 60 70
0 5 10 15 20 25 30 35 40
SPEED OF TRUCK IN MILES PER HOUR

Figure 7
Truck Factor for Various Average Truck Speeds

1. **Highway Capacity Manual**, Highway Research Board, Washington, D.C. 1950.

given distribution of passenger car speeds (average of curves A and B, Figure 3). Figure 7 shows for example that a truck traveling 20 mph is equivalent, in a capacity sense, to thirteen passenger cars, regardless of the grade required to reduce the truck's speed to 20 mph. Similar curves can now be prepared for any two-lane highway when normal passenger car speeds are available.

The quantitative effect that trucks have on the capacity of multilane highways is not as well known, however, as for two-lane highways. It is entirely possible that a few heavy trucks on a long steep grade of a multilane highway might have as great an effect as a much larger number. Research is needed in this field to establish more reliable information than is presently available.

Capacities for Uninterrupted Flows

It is highly significant that there has been no measurable change over a twenty-year period in the maximum possible number of vehicles that two-lane and multilane highways can accommodate when the flow is not interrupted by intersections. Results of studies conducted between 1934 and 1941 showed that the total possible capacity of a two-lane highway and the possible capacity per lane of a multilane highway was 2,000 to 2,200 vehicles per hour.[2] In 1948, with additional information available, the Highway Research Board's Committee on Highway Capacity adopted the rounded figure of 2,000.[3]

Extensive studies conducted during recent years by the California Division of Highways[4] and by the Bureau of Public Roads in co-operation with a number of state highway departments show that these same figures continue to be applicable. In fact, traffic counts made as far back as the years when all passenger cars had only two-wheel brakes indicate that these same peak hourly capacities were attained at that time.[5] Some investigators using limited data have concluded that possible capacities are greatly in excess of these values but no such traffic volumes have ever been recorded.[6,7] Vehicle headways, in terms of time, during peak volumes have remained unchanged despite the many improvements in vehicle performance during the last twenty years.

Even the skewed distribution of time-spacings between vehicles (c. to c.) has remained esentially unchanged for twenty years, with nearly half of the vehicles at less than the average time-spacing. One use of the headways or time-spacings between vehicles is to determine the relative road space that various classes of vehicles occupy.

In this connection, it is generally found that the average dual-tired truck occupies about twice as much road space as the average passenger car on a level section of highway. It is of interest, however, that under this condition about ten per cent of the passenger cars are driven in such a manner that they occupy or use more road space capacitywise than the average dual-tired truck. Likewise, the small sport model cars may occupy a smaller parking space than the normal sized passenger car but on the road, when mixed with other traffic at high volume, they use somewhat more of the road capacity than the normal sized passenger car.[8]

Horsepower vs. Passing Ability

Everyone is familiar with the arguments for and against the increases made since the end of World War II in the horsepower of passenger cars. One of the advantages cited is the ability to complete passing maneuvers in less time, thus reducing the possibility of being caught in the left lane of a two-lane road with an oncoming vehicle rapidly reducing the time interval, sometimes between life and death. Closely allied with horsepower or acceleration ability, and perhaps equally important, is the lower height of the driver's eyes in the newer cars —a height that, under certain highway conditions, reduces the distance over which the driver can see a clear road ahead.

Many drivers have become sufficiently concerned with the change in these two characteristics of vehicle design to recommend that their effect as related to the present practices of marking no-passing zones on two-lane highways be investigated. A step has been taken in that direction.

Between 1938 and 1940 the Bureau of Public Roads conducted a comprehensive series of investigations of passing practices on two-lane highways. Detailed data were recorded for a total of 21,000 passing maneuvers at thirty-two locations in seven states. In looking for sites to observe present-day practices, it was found that at three of these old locations there had been no change since 1938 in the geometric highway features—surface width and

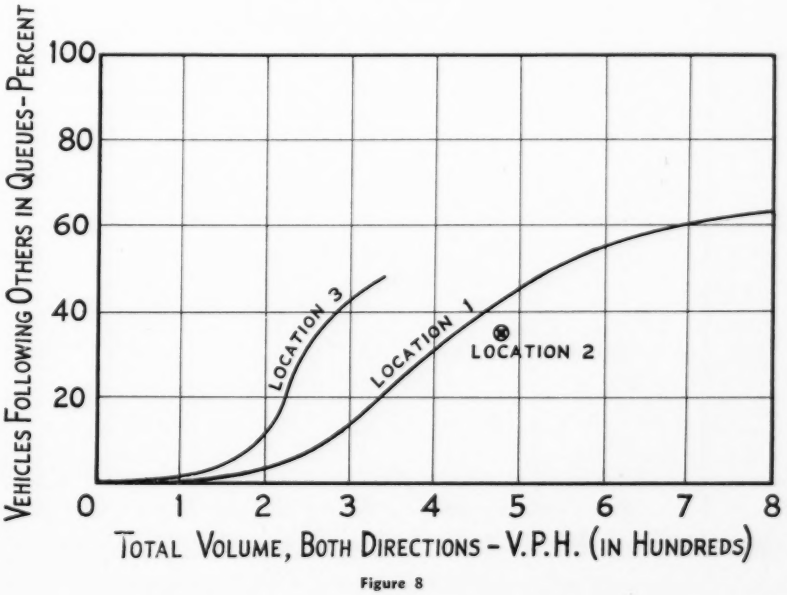

Figure 8

2. **Public Roads**, February 1939.

3. **Highway Capacity Manual**, Highway Research Board, 1950.

4. **Freeway Capacity Study**, 1956. George M. Webb and Karl Mackowitz. Highway Research Board Proceedings 1957.

5. **Highway Research Board Proceedings** 1931. Dean A. N. Johnson.

6. **A Study of Traffic Capacity**, Bruce D. Greenshields. Highway Research Board Proceedings 1934.

7. **Speed, Headway and Volume Relationships on a Freeway**, T. W. Forbes, 1951 Proceedings ITE.

8. Preliminary results from related studies underway by Bureau of Public Roads.

condition, shoulder width, and sight distance conditions remained unchanged for nearly twenty years. Thus they were ideal locations to obtain a comparison of present passing practices with those in 1938 when cars had lower horsepower ratings.

Data were obtained during the recent studies by manual observation and were much less detailed than the 1938 records made with electromechanical equipment. Manual recording furnished sufficient information to reveal any marked change in passing practices over the nineteen-year period.

One study section had an 1,800-foot passing sight-distance between a horizontal and a vertical curve; the second had a 2,400-foot sight distance between two vertical curves; and the third, a 3,300-foot sight-distance between a vertical and a horizontal curve. Each was the best passing location for several miles.

The studies were scheduled so that traffic volumes and study periods were similar to those for which data were recorded in 1938.

There was a high demand on all sections for passing maneuvers as measured by the percentage of vehicles following other vehicles at short headways in a queue of two or more vehicles as if anticipating an opportunity to pass. Figure 8. At location 1, the studies were conducted under a wide range of traffic volumes. The percentage of vehicles in queues being restricted in speed increased with an increase in traffic volume. At location 2, the traffic volume was constant during the study on three different days. Location 3, with the longest sight-distance, had the highest percentage of vehicles traveling in queues at low traffic volumes because sight-distances sufficient for passing were less frequent than on the other two.

Figure 9 shows the number of passings accomplished per hour on the three sections during various hourly volumes, in 1938 and 1957. On section 1, with the shortest passing sight-distance, less than one-third as many passings were accomplished during the 1957 studies as during the 1938 studies at similar traffic volumes. At the second location, with the intermediate sight-distance, 39 passings per hour were performed in 1957 as compared with 52 in 1938 at the same traffic volume. At the third location, with the longest sight-distance, more than twice as many passings were performed per hour in 1957 as in 1938 with similar traffic volumes.

Drivers are now apparently more reluctant to undertake a passing maneuver on shorter sight-distance sections and less reluctant on longer sight-distance sections than drivers in 1938. Drivers today are perhaps more cautious or have a better understanding of the danger involved in performing passing maneuvers at short sight-distances, despite the increased horsepower of their vehicles, than drivers in 1938. But such conclusion is unwarranted by these limited studies.

Table I compares numerically the results of the 1938 and 1957 studies.

Detailed data were obtained for 608 passing maneuvers in 1938 and for 476 in 1957. The 1957 data were separated into two groups, one including passing maneuvers by 1954-model or older vehicles; the other including 1955, 1956, and 1957 models. The break was made between the 1954 and 1955 models because between these two years most automobile manufacturers made the greatest increase in horsepower.

From 1938 through 1954 there were periodic increases in the horsepower of practically all makes which, over the years for some of them, totaled considerably more than the 1954-1955 increase. It seemed desirable to divide the 1957 study data into two groups, particularly since the one group thus includes only "new" vehicles — those less than two-and-a-half to three years old.

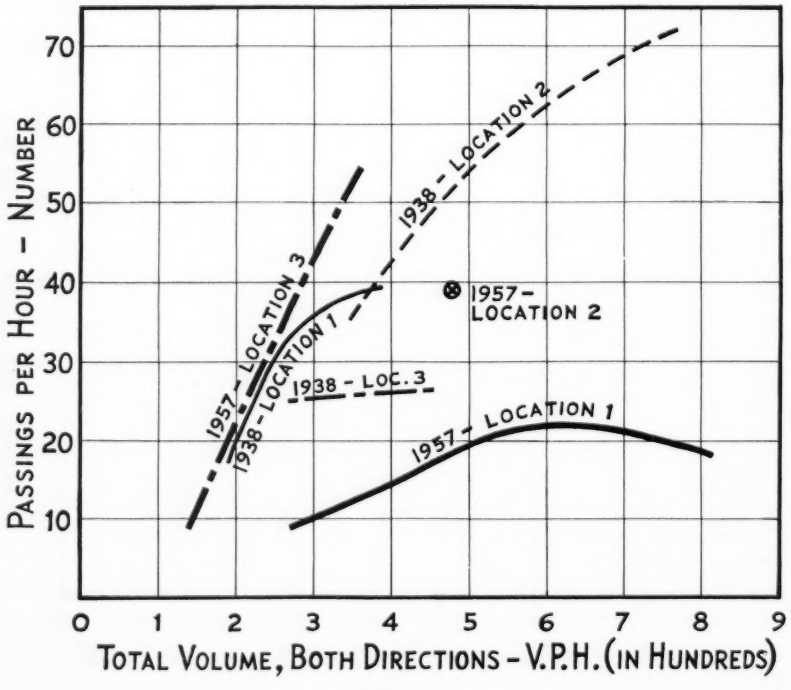

Figure 9

Passing Practices Show Little Change

Speeds of both passed and passing vehicles were higher in 1957 than in 1938. The passed vehicles in 1957 were moving three to four miles per hour faster than in 1938, and speeds of passing vehicles were six to seven miles per hour higher. The average speed of vehicles unobstructed by a vehicle ahead was five miles per hour higher in 1957 than in 1938. The average difference between the speed of passed vehicles and the speed of passing vehicles, during the maneuver, was ten miles per hour in 1938 and thirteen in 1957, as shown in Table I.

Time spent in the left-hand lane by the newer vehicles in 1957 was 0.5 second shorter than in 1938. The distance traveled in the left lane, however, increased 100 feet. Thus it would appear that increasing the average horsepower, from 1938 to 1956, by about 75 per cent has decreased the time needed to pass by about five per cent, but has resulted in an increase of

the distance traveled in the left lane by about 19 per cent.

This finding obviously is not in accordance with what might have been expected and illustrates the importance of research, for inquiry into the manner in which people operate their vehicles must be based on careful study of actual performance rather than on speculation or assumed driving practices.

From the most carefully planned and executed studies, average values may be misleading. More important in connection with passing maneuvers may be a driver's ability to accelerate his vehicle quickly and get out of a tight spot. Table II shows the shortest time intervals and the average for the ten per cent of passing maneuvers made most rapidly. Values are included for two types of passing maneuvers—"delayed starts" and "flying starts."

Delayed starts include maneuvers by vehicles that had slowed down to the approximate speed of the vehicle to be passed prior to entering the left lane. Flying starts include maneuvers by vehicles that entered the left lane at a speed considerably higher than the speed of the vehicle to be passed. There is no consistent difference between the 1938 and 1957 values for either of these groups, and the significance of the figures is obscure. In general the new vehicles were in the left lane a slightly shorter time than in 1938, but the time for the fastest maneuvers has not changed.

Similar information for maneuvers in which passing vehicles occupied the left lane for shorter distances indicates approximately the same relative difference between 1938 and 1957 data as the average values, Table III.

Since no accidents occurred at these three locations during either the 1938 or 1957 studies, and accident data that relate horsepower to accidents during passing maneuvers are not available, the accident potential of increased horsepower must be measured by the percentage of maneuvers completed shortly before meeting an oncoming vehicle or after reaching the no-passing zones. Table IV shows the percentage of passing maneuvers of this type.

When the distance is less than 200 feet between two vehicles traveling toward each other at 50 miles per hour on a two-lane highway, they will meet in about 1.4 seconds. Two and one-half per cent of the passing maneuvers studied in 1938, and one-half of one per cent of those studied in 1957 involving the newer group of cars, were completed with oncoming vehicles less than 200 feet away. This is a significant difference.

Figures for the other items shown in Table IV are also lower for late model cars observed during the 1957 studies than for the 1938 studies. Whether or not horsepower ratings had anything to do with these results has not been determined. Driver training and a variety of other factors may have had a more pronounced effect than the vehicle horsepower. Certainly, the new-car drivers in 1957 were taking fewer chances.

TABLE I

COMPARISON OF PASSING PRACTICES IN 1938 AND 1957

Study section	1938 study: all models	1957 study: 1954 and older models	1957 study: 1955-57 models
Number of passings studied			
1	130	46	90
2	245	69	139
3	233	45	87
Total	608	160	316
Average speed of passed vehicles—m.p.h.			
1	34	34	36
2	35	38	39
3	36	42	42
Average	35	38	39
Average speed of passing vehicles while in left-hand lane—m.p.h			
1	44	48	50
2	45	51	50
3	46	54	56
Average	45	51	52
Average time passing vehicles were in left-hand lane—seconds			
1	11.4	9.0	9.0
2	9.0	9.3	9.0
3	10.1	11.9	11.1
Average	10.2	10.1	9.7
Average distance passing vehicles were in left-hand lane—feet			
1	740	630	650
2	540	700	660
3	640	950	910
Average	640	760	740
Average speed of free moving vehicles—m.p.h.			
1	42	44	
2	41	42	
3	40	49	
Average	41	45	

Research in Intersection Capacities

In an entirely different field of traffic-capacity research, the change in intersection capacities is an illustration of the need for keeping abreast of changing traffic conditions. In 1946, through the cooperation of members of the Institute of Traffic Engineers and highway officials throughout the country, it was possible to obtain data and complete an analysis of intersection capacities.

For the first time, reasonably reli-

TABLE II

MINIMUM TIME THAT PASSING VEHICLES OCCUPIED LEFT-HAND LANE

Study section	Delayed start			Flying start		
	1938 study	1957 study		1938 study	1957 study	
	all models	1954 and older models	1955-57 models	all models	1954 and older models	1955-57 models
	Minimum time					
	Seconds	Seconds	Seconds	Seconds	Seconds	Seconds
1	5.6	4.0	4.5	5.5	5.0	4.0
2	4.3	4.5	4.0	3.8	3.0	4.0
3	4.6	5.0	6.0	4.1	5.0	5.2
Average	4.8	4.5	4.8	4.5	4.3	4.4
	Average time for 10 per cent of the passings made in the shortest time					
1	7.6	5.0	5.0	6.9	5.0	5.9
2	5.1	5.9	5.2	4.6	5.6	5.2
3	5.8	5.8	6.4	4.9	6.2	6.6
Average	6.2	5.8	5.5	5.5	5.6	5.9

TABLE III

SHORTEST DISTANCE THAT PASSING VEHICLES TRAVELED IN LEFT-HAND LANE

Study section	Delayed start			Flying start		
	1938 study	1957 study		1938 study	1957 study	
	all models	1954 and older models	1955-57 models	all models	1954 and older models	1955-57 models
	Minimum distance					
	Feet	Feet	Feet	Feet	Feet	Feet
1	300	340	370	350	350	300
2	170	290	200	170	150	500
3	310	300	450	260	250	430
Average	260	310	340	260	250	410
	Average distance for 10 per cent of the passings made in the shortest distance					
1	450	380	430	450	410	490
2	320	460	310	240	480	530
3	370	420	550	360	400	510
Average	380	420	430	350	430	510

able data were obtained for intersection design and for predetermining both quantitatively and qualitatively the resulting increases in street capacities by eliminating parking, eliminating right or left turns, providing one-way street systems, widening streets, and many other possible traffic control and construction improvements. These data afforded a much-needed tool for the highway and traffic engineering professions.

But tools become dull with use and obsolete if not improved. During the last two years, with the help of many of the same organizations, data for some 1,200 congested intersection locations were obtained for analysis. This number is more than four times the number available in the previous analysis, and the data for each of these are far more comprehensive and possibly somewhat more accurate.

The analysis—which involves forty-five different variables—is now underway by employing electronic computer techniques. Prior to starting the analysis, much work was done by the supervisor to obtain the parameters of the many variables and some preliminary results. The final results may modify the entire approach to the analysis of intersection capacities. Based on an approach similar to the one used in the 1950 manual, it has been possible to show pertinent changes in intersection capacities during the last ten years.

In general there has been a substantial increase in intersection capacities—a fortunate trend that has done much to keep traffic conditions from becoming progressively worse at a much faster rate. The most pronounced increase has taken place on the wider streets.

Figure 10 shows a comparison of 1946 and present capacities of intersections on two-way streets in downtown areas by street widths. The dotted lines, representing present conditions, curve in one direction while the solid lines, representing conditions about ten years ago, curve in the other direction. The wider streets which, on an average, were less efficient per foot of width than the narrower streets, are now more efficient per foot of width. A similar change has occurred at intersections in other areas of the cities in which data were recorded.

What brought about these increased intersection capacities, particularly of the wider streets? Changes in vehicle design to improve performance and ease of operation have no doubt had a substantial effect; but it is believed that most of the increase has resulted from the application of improved traffic control techniques and regulations—separate right and left turn lanes, better enforcement of parking regulations, and the development and proper use of improved traffic control equipment.

Wider streets have shown a greater increase in capacity than narrower streets because their potential capacities, until recently, were not fully realized. The "know-how" of dealing with large volumes of traffic on city streets and with individual drivers that seriously impede traffic flow has also been improved.

What would traffic conditions be today if there had been no improvement in traffic control practices, and street capacities had remained as reported by Mr. Hawley S. Simpson in his award-winning paper before the ASCE in 1934? At that time he found that a second lane in each direction added 78 per cent to a street's capacity, the third lane added an additional 56 per cent, the fourth lane added 26 per cent, and the fifth lane added nothing. Three lanes in each direction were only 78 per cent as efficient per lane

as a single lane in each direction. The corresponding figure today on city streets is about 115 per cent. Likewise, in rural areas, one four-lane divided highway will accommodate three to five times as much traffic as a two-lane highway—and with a lower accident rate.

A preliminary look at results being obtained by the current analysis of intersections with fixed time signals is presented in Figures 11 and 12. These are average values for various types of streets, with about half the streets accommodating more traffic and half of them less traffic than indicated by the curves. Upon completion of the analysis, it is expected that far more will be known regarding reasons for variation in intersection capacities than has been known in the past. It is expected that it will be possible to establish reliable factors for many of the forty-five different variables. The effect of the more important ones now covered in the present manual—turning movements, commercial vehicles, and bus stops—and many others not now included will be accurately determined from the large volume of data available.

Great Improvement Possible Through Research

Completion of this analysis should, however, be only the beginning of a determined effort to improve traffic on city streets through research. With a better knowledge of the effect of the many factors involved and availability of electronic computers, improvement of traffic conditions on a street system throughout a large metropolitan area by simulation and electronic control can then become a reality rather than a highly theoretical approach based largely on unverified assumptions.

Ranking high in a priority program of needed additional information for use with simulation techniques will be the change in length with time and distance of queues of vehicles as they pass through one intersection and approach the next intersection.[9] In my opinion, little is gained by simulating traffic conditions at an individual location over and above that now possible by other more direct methods. Simulation will, however, soon become a most important tool for co-ordinating

9. "The Platoon Movement of Traffic from an Isolated Signalized Intersection," by Bryan J. Lewis. Bulletin No. 178 Highway Research Board.

TABLE IV

PERCENTAGE OF PASSING MANEUVERS COMPLETED WITH SHORT DISTANCES TO ONCOMING VEHICLES OR AT POINTS WHERE SIGHT DISTANCES WERE SHORT

Study section	1938 study: all models	1957 study: 1954 and older models	1957 study: 1955-57 models
Oncoming vehicle less than 200 feet away			
	Percentage of passing maneuvers		
1	1.5	6.5	0
2	3.7	1.5	1.4
3	2.2	2.2	0
Average	2.5	3.4	0.5
Oncoming vehicle less than 300 feet away			
1	4.7	8.7	5.6
2	9.8	3.0	5.1
3	5.2	2.2	0
Average	6.6	4.6	3.6
Sight distance less than 300 feet			
1	5.4	0	0
2	4.1	1.4	0.7
3	0.9	0	0
Average	3.5	0.5	0.2
Sight distance less than 600 feet			
1	29.3	26.1	22.2
2	11.5	8.6	12.2
3	5.6	11.1	2.3
Average	15.5	15.3	12.2

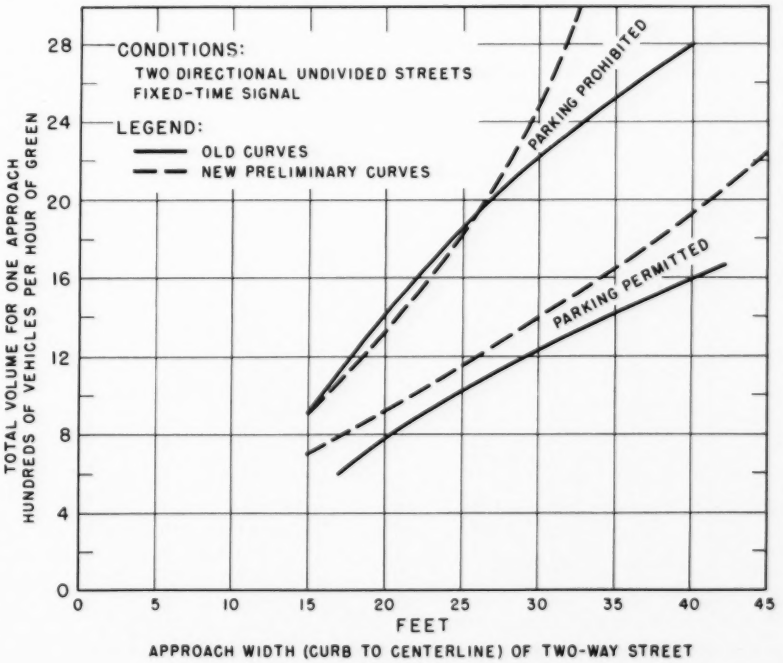

Figure 10
Average Intersection Capacities of Downtown Two-Way Streets

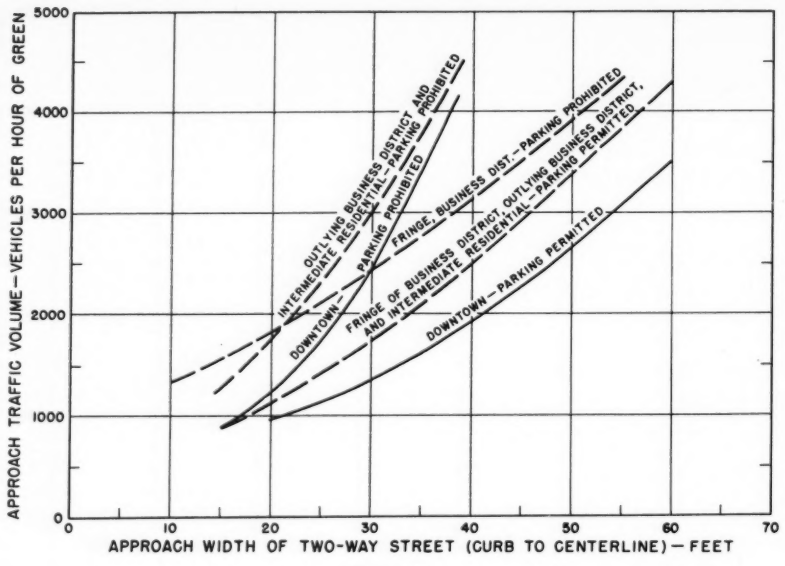

Figure 11
Intersection Capacities of Two-Way Streets. Fixed-Time Signals

the traffic flow on entire street systems and between systems.

It is almost pathetic how little is really known about the efficiency or inefficiency at which our existing traffic facilities are being operated. This is not the fault of the traffic engineering profession. Rather it is caused by insufficient research to develop improved methods. Time-space diagrams for establishing progressive movement on an interconnected signal system, for example, are entirely inadequate for the purpose they are intended to serve. They continue to be used only because improved methods that take into consideration several important factors other than time and distance have not been developed despite their great need.

The rapidly increasing mileage of freeways has already made it apparent that improved and new techniques are required to maintain a smooth and safe flow of traffic, especially in the vicinity of interchanges where heavy volumes leave and enter the freeways. In this connection, some engineers tend to believe that each interchange will cause some degree of interruption to freeway traffic, and that a minimum distance—one-half mile, one mile, or two miles—should be spaced between interchanges to obtain proper traffic operation. Both of these beliefs are true to the extent that it has generally been at, or in the vicinity of, ramp exits and entrances that the greatest congestion has occurred on existing freeways.

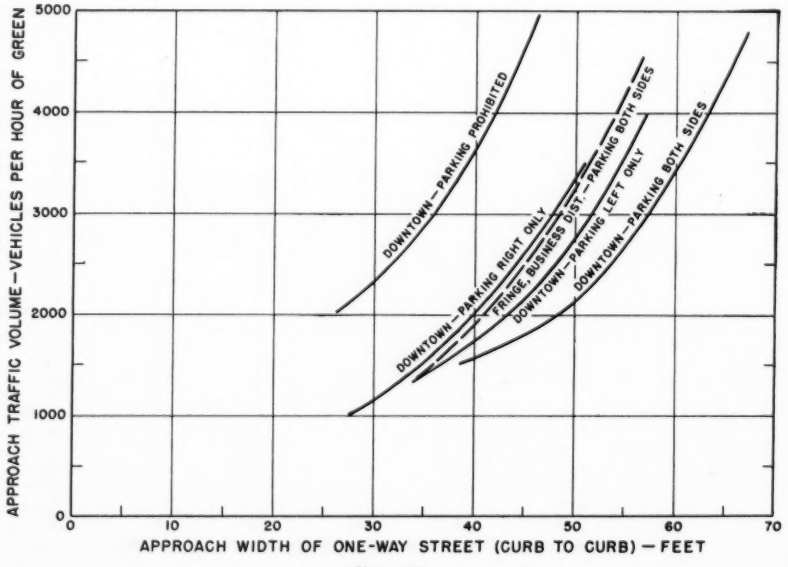

Figure 12
Intersection Capacities of One-Way Streets. Fixed-Time Signals

If properly designed for the volumes that will use them, ramp entrances and exits need not impede the smooth and safe flow of traffic on the freeway. Likewise, the best spacing of interchanges will vary with specific traffic conditions. In some areas, greater frequency with less traffic per ramp will affect freeway traffic less than fewer ramps with heavier traffic volumes. In some cases a definite improvement has resulted by constructing two ramps closely spaced to handle a volume originally intended for one ramp. Desirable operating conditions must, therefore, be attained by proper design for existing and future conditions, rather than by adoption of minimum spacing of interchanges or ramps in rural or urban areas.

Inadequate merging and weaving distances, or failure of the designer to recognize the existence of a weaving area in his layout have been the two principal causes of congestion observed on existing freeways—excluding overloaded facilities and abnormal conditions from accidents and vehicle breakdowns.

An inadequate merging distance will increase the accident potential, cause traffic slowdowns, and reduce the capacity of freeway through lanes. Whenever a highly congested condition with stop-and-go operation occurs on a freeway in the vicinity of an entrance ramp or at the connection with another roadway, and the traffic on the section beyond the ramp averages less than 2,000 passenger cars per lane (or the equivalent mixed traffic), the cause of congestion can generally be attributed to an inadequate merging distance or a design that does not encourage drivers to use the available merging distance.

On some freeways, inadequate merging distances have cut the "going away" volume or number of vehicles leaving such a location from 2,000 to 1,700—sometimes to 1,400 — passenger cars per lane per hour. This lag occurs on freeways that at other locations sometimes accommodate peak volumes in excess of 2,000 vehicles per lane.

Freeways are generally designed for practical capacities well below 2,000 vehicles per hour per lane in order to provide reasonable operating speeds. It is believed, however, that ramps, weaving areas, and other facilities that influence the capacity of main roadways should be designed so that main roadways can accommodate 2,000 vehicles per hour per lane. Unless this is done, main roadways will not accommodate their design volumes at desired speeds, nor will they carry infrequent overloads without extreme congestion.

After a freeway has been designed for a practical capacity of 1,000 to 1,500 vehicles per lane, depending upon desired operating speeds during the design hour, the design should be checked to determine whether the road has a possible capacity of 2,000 vehicles per hour per lane. Usually such a check will reveal that relatively minor changes are required in acceleration-lane lengths and in the design of weaving sections. This procedure seems reasonable in view of the uncertainty in predicting future traffic volumes and the difficulty of making even minor changes once a freeway is in operation.

Extensive studies are now under way to determine the effect of ramp design on traffic capacities and the resulting influence on freeway traffic. These studies will be continued as additional freeways are completed and new designs are loaded with traffic approaching capacity volumes. Much needs to be learned before terminals of entrance and exit ramps can be designed on a more scientific basis wtih the assurance that traffic will use these areas—including acceleration and deceleration lanes—as intended by the designer.

Weaving Area Capacities Have Improved

Traffic behavior at weaving areas is closely allied with entrance and exit ramps since weaving maneuvers are generated by the need of one traffic stream to cross another traffic stream using a different entrance and exit. A merging maneuver required at the entrance terminal of a ramp is also similar to the type of merging maneuver required during an early stage of a weaving maneuver.

Results of recent investigations to determine operating capacities of weaving sections are shown by Figure 13. A comparison of this figure with a similar one in the 1950 Highway Capacity Manual shows that over a ten-year period the possible capacities of weaving sections have substantially increased. The top curve still starts at 1,400 maneuvers per hour for the shortest length possible, but is 20 per cent higher than the old curve for a section 1,000 feet long. There has also been some increase for the 30 mph operating speed, but no apparent change for the higher operating speed of 40 mph.

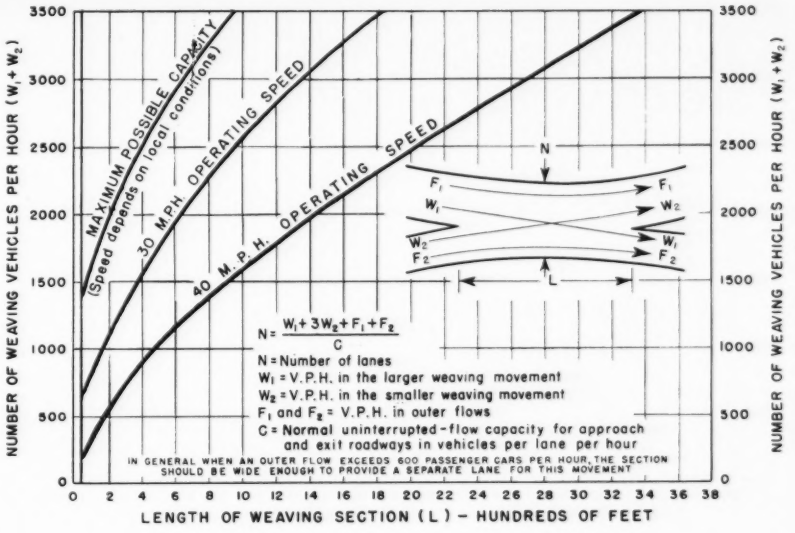
NUMBER OF WEAVING VEHICLES PER HOUR (W_1+W_2)
3500
3000
2500
2000
1500
1000
500
0
MAXIMUM POSSIBLE CAPACITY
(Speed depends on local conditions)
30 M.P.H. OPERATING SPEED
40 M.P.H. OPERATING SPEED
N
F_1
W_1
W_2
F_2
L
$N=\frac{W_1+3W_2+F_1+F_2}{C}$
N = Number of lanes
W_1 = V.P.H. in the larger weaving movement
W_2 = V.P.H. in the smaller weaving movement
F_1 and F_2 = V.P.H. in outer flows
C = Normal uninterrupted-flow capacity for approach and exit roadways in vehicles per lane per hour
IN GENERAL WHEN AN OUTER FLOW EXCEEDS 600 PASSENGER CARS PER HOUR, THE SECTION SHOULD BE WIDE ENOUGH TO PROVIDE A SEPARATE LANE FOR THIS MOVEMENT
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
LENGTH OF WEAVING SECTION (L) – HUNDREDS OF FEET

Figure 13
Operating Characteristics of Weaving Sections

It should always be kept in mind when using Figure 13 that it was prepared for design purposes and for that reason shows traffic capacities that can be attained or exceeded at most locations. The length, width, and capacity of a section are interrelated to the extent that several combinations of length and width can be used for a given traffic condition.

The values obtained from Figure 13 will result in a balanced design within a minimum length. When longer-than-minimum lengths are available, reductions in the total width can be made in accordance with a recent article published by the Highway Research Board.[10] This article also explains other considerations that apply to weaving sections.

Traffic engineering is a dynamic field dealing with ever-changing conditions. The trend toward construction of freeways in both rural and urban areas in an effort to solve some of our worst traffic problems is a result of these changing conditions. Comparatively few modern freeways have been placed in operation in urban areas, but it is already apparent that new techniques and operational skills are required to maintain a smooth, safe flow of traffic, especially in the vicinity of interchanges where heavy volumes leave and enter the freeways. Through research, basic principles of traffic flow can be developed that may make our present methods appear as obsolete tomorrow as a 1930 automobile does today.

Closed circuit television for scanning trouble spots, radar detection, and the use of high speed computers in traffic control as well as for simulating traffic conditions in solving complex problems will soon become everyday tools of traffic engineers. The full benefit of these developments will be realized, however, only by following Ted Matson's example—constant search for new knowledge.

10. "Operation of Weaving Areas," Page 38, Highway Research Board Bulletin Number 167, January 1957.

— REPRINTS AVAILABLE —

A limited number of reprints of the 1958 Matson Memorial Award paper by D. Grant Mickle entitled "Traffic Engineering in Tomorrow's Transportation," which appeared in the January 1959 issue of TRAFFIC ENGINEERING, are available without charge from Institute headquarters. Write to ITE, 2029 K Street NW, Washington 6, D.C.

Effectiveness of Speed Limit Signs

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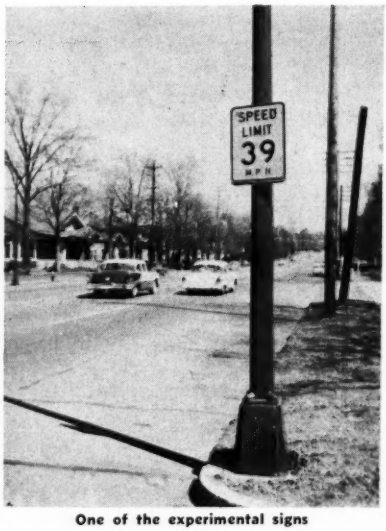
In 1956, the City of Nashville had a maximum speed limit of 30 miles per hour which had been in effect for many years. With continued improvement of streets and roads, with improvements in the safety features of the modern automobile and with improvement of traffic control and regulations, it had become apparent to many that the time had come when the universal 30 mph limit was too slow for some sections of the city.

The City of Nashville Traffic Commission had many requests from various individuals and groups to raise the the speed limit to 35, 40, or 45 miles per hour. Others had stated that the speed limit should be set at some odd number such as 34 or 39 miles per hour in hopes that the odd numbers would attract attention and thus improve observance of the posted speed limit.

Before deciding on a given speed limit for the city or for certain streets within the city, it was necessary to know what effect, if any, speed limits had on traffic flow and to find out if odd numbered speed limits had any merit in increasing speed sign observance. From analysis of data collected, it was also hoped that it could be determined what merit there was in using the 85 percentile speed as recommended by many traffic safety groups and traffic engineers.

Three streets within the City of Nashville were selected for the study (1) West End Avenue from Park Circle to the City Limits (1.0 mi) (2) Charlotte Avenue from 31st Avenue to 42nd Avenue North (0.9 mi) and (3) 12th Avenue South from South Street to Acklen Avenue (1.0 mi).

West End Avenue through this section is a two-way major arterial street carrying 4 lanes of moving traffic (each lane 12 feet wide with a 4-foot mountable "whistle strip" median), 7-foot parking aprons and wide sidewalks on either side. This section, which carries Nashville-Memphis intercity traffic, has a very slight downgrade westward and bears a traffic volume of 24,000 vehicles daily. Local streets intersect about every 400 feet and there is one traffic signal near the east end of the section. There is no commercial development and few pedestrians. Thirty mph speed limit signs have been posted here for some years. The actual speed observation point was near Leonard Avenue located close to the center of the one mile section.



One of the experimental signs

Charlotte Avenue through the test section is a high-type 2-way major arterial street and state highway carrying 4 lanes of moving traffic, parking on both sides with a 60-foot curb to curb width. The area is mostly residential with only an occasional small store. There are few pedestrians crossing this section and no traffic signals. Lightly travelled local streets intersect about every 200 feet and traffic volume averages 15,000 per day. Before this study began, there were no speed limit signs posted. The actual speed observation point was near 36th Avenue North where the street has a slight downgrade westward.

12th Avenue South is a minor arterial street. It carries traffic from residential to downtown areas and is not a state highway. Near Horton Street where the vehicle speeds were observed there is dense residential development mixed with small stores on both sides of the 38-foot curb to curb street. Parking is permitted on either side except during the peak hours. Pedestrians are numerous in the area and inadequate sidewalks cause considerable mid-block pedestrian crossing. There is a traffic signal located about 1000 feet north of Horton (at Edgehill). Traffic volume averages 6,800 daily. Before this study was conducted, there were no speed signs posted.

Study Procedure

The general procedure of the study was to sample the speed actually travelled by the motorists on the test section in each direction under both day and night, peak and offpeak, conditions. Then speed limit signs were changed or erected (in the case of those streets which originally had no signs), at least one month elapsed and the speeds of vehicles were again sampled. The signs were again changed and the whole procedure repeated. Table I indicates which streets were tested with what signs. A radar speed meter was used throughout the study for measuring vehicle speeds. It was set up somewhere near the middle of each test section and suitably disguised so drivers would not be aware of the test.

Preliminary analysis of the variation in speeds at each location revealed that 300 observations would yield an

average speed within 1 mph of the true average with a .95 confidence limit.[1] Since actually 500 speed observations were made at each location under each condition it can be shown that the error due to sampling is not greater than plus or minus 0.5 mph at the .95 confidence limit. Since this error is less than the error anticipated in measuring the speed of each vehicle, the sampling is considered adequate.

Three speed limit signs were placed upstream from the observation point, the signs being spaced at distances of about 1000 feet. Standard 18″ x 24″ reflectorized signs were used.

The city police were informed of the study being conducted and of the speed limit changes which were going to be effected. It was pointed out to them that no special enforcement was desired. The newspapers and TV carried stories that a study was in progress and the general idea behind the study. The odd numbered speed signs (34 and 39 mph) gained considerable publicity when first erected but by the time the speed observations were made this had subsided. All stories released pointed out that only the usual enforcement measures were being taken.

Data Analysis

For each set of observations, the average speed, eighty-five percentile speed, standard deviation,[2] the pace[3] and the percentage of vehicles within the pace, were computed. The results of these calculations are shown in Table I.

The one location where observations were made at night (west bound West End Avenue) indicates that speeds are generally lower at night under otherwise similar conditions. Only when the 34 mile per hour signs were in place were the day and night speeds equal. The greatest difference (2 mph) in day-night average speeds occurred with the 30 mile per hour signs in effect. The average difference between day and night average speed for any speed limit tested was 0.8 miles per hour.

Probably the greatest and most consistent speed difference measured was the difference between speeds travelled

TABLE I

ANALYSIS OF SPEED ZONE DATA

		No Signs					30 mph Signs					34 mph Signs					39 mph Signs				
					Std.				Std.		% in			Std.		% in			Std.		% in
Time	Dir.	Avg.	85%	Dev.	Pace	Pace	Avg.	85%	Dev.	Pace	Pace	Avg.	85%	Dev.	Pace	Pace	Avg.	85%	Dev.	Pace	Pace
									West End Avenue												
									3-57					10-57					7-57		
Day	EB	—	—	—	—	—	33.3	37	5.60	28-38	67	33.7	39	4.95	29-39	70	34.7	40	5.32	29-39	70
Day	WB	—	—	—	—	—	35.0	40	5.03	29-39	67	34.0	40	5.11	29-39	69	35.3	40	4.63	30-40	74
Night	WB	—	—	—	—	—	33.0	36	4.84	28-38	72	34.0	38	4.87	28-38	73	34.7	39	4.81	29-39	73
									Charlotte Avenue												
									3-57					7-57					10-57		
Day	EB	32.3	38	5.73	27-37	62	—	—	—	—	—	33.0	38	5.51	28-38	67	32.8	39	5.68	28-38	64
Day	WB	33.7	39	5.03	28-38	72	—	—	—	—	—	32.2	37	5.02	27-37	72	33.8	39	5.40	29-39	69
Day*	WB	30.8	35	4.21	26-36	79	—	—	—	—	—	30.0	34	4.00	25-35	81	31.7	36	4.50	26-36	79
									12th Avenue South												
									New Pavement												
									3-57					10-57					7-57		
Day	NB	28.3	33	5.08	23-33	71	28.6	34	5.18	24-34	71	28.0	33	5.46	23-33	76	—	—	—	—	—
Day	SB	26.0	31	4.8	20-30	74	29.8	35	4.86	25-35	72	27.0	31	4.32	23-33	77	—	—	—	—	—
Day*	SB	25.6	30	4.3	20-30	80	26.5	31	4.51	22-32	78	26.2	30	3.83	21-31	83	—	—	—	—	—

*Evening peak traffic conditions

[1] In other words if 100 samples were drawn each with 300 observations, then we could reasonably expect 95 samples to yield means within 1 mph of the true mean.

[2] In this study, the standard deviation is used as a measure of the variation in speeds at a given location.

[3] The pace is the 10 mph speed range within which more vehicles were travelling than any other 10 mph range.

during peak and offpeak conditions. On both Charlotte and 12th Avenue South, under any speed limit, speeds averaged 2 mph slower during peak volume conditions than during offpeak. Vehicles travelled at a more uniform speed during the peak hours as indicated by the standard deviations and the percentage of vehicles in the pace. It should be pointed out that at no time during the peak periods tested was there severe congestion on any of the streets tested. Traffic flowed continually peak or offpeak.

The only other really significant and constant speed change noted was in the speeds sampled on 12th Avenue South wtih the 30 mph speed signs in place. In Table I it can be seen that higher speeds were observed with the 30 mph signs than with any other signing. This can possibly be attributed to the new asphalt paving which was laid on this section just prior to making the observation with the 30 mph limit. It should be pointed out that the previous pavement was far from bad and was reasonably smooth with no pavement breaks. However, the new black paving with the bright new pavement markings apparently had more effect on the speed of the traffic flow than did any speed limit put into effect.

In an effort to directly compare the effect of various speed limits with one another Table II was prepared. It can be seen that there was no significant change in the uniformity of the speeds as represented by the standard deviation for various speed limits. The speed uniformity of the flow as represented by the percentage of vehicles in the pace indicates that speeds are slightly more uniform using the 34 mph limit than with any other, and very slightly more uniform using either the 34 or 39 mile per hour limits than when either the 30 mph or no signs at all are used. The significance in this percentage is questionable since it is so slight.

The changes in average speed with changes in speed limit are quite variable and often inconsistent as shown in Table II. The 39 mph signs do show a 1.0 mph increase above the 34 mile per hour limit and a 1.3 mph increase above the 30 mph limit. However, the average speed with no signs in place was lower than when either the 30, 34, or 39 mph signs were used.

The 85 percentile speed for West End and Charlotte Avenue appears to be very near 39 mph. Thus all the data for the 39 mph signs in both Table I and Table II may be considered as indicative of traffic performance when the speed limit is set at the 85 percentile speed. Table I indicates that a greater uniformity of speed prevails when the 85 percentile speed limit is used than when the 30 mile speed limit was used. However, a slightly higher percentage of vehicles were in the pace with the 34 mph limit than with the 85 percentile speed limit. The average speed was about 1 mph faster with the 85 percentile limit than with slower limits.

Comparison with Some Other Speed Studies

From the data and analysis presented above, it appears that the speed limits have very little if any significant effect on the performance of drivers in the traffic stream. This conclusion is borne out by a study [4] conducted by Mr. C. C. Wiley, Professor of Highway Engineering, at the University of Illinois. His study was conducted on the streets of Champaign, Illinois and resulted in the following conclusions:

"1. Traffic consistently ignores posted speed limits and even the absence of speed limit signs, and runs at speeds which the drivers consider reasonable, convenient and safe under existing conditions.

2. Drivers do not operate by the speedometer, but by the conditions they meet.

3. The general public gives little attention to what speed limits are posted.

4. Most present posted speed limits are ineffective because they are unreasonable and hence are useless. Their removal would have virtually no effect on traffic and would save large sums of money."

On the other hand, some studies [5] made on rural roads in several states have indicated that establishment of the speed limit at the 85 percentile level has a beneficial effect in lowering the average speed and causing more uniformity in the speed distribution. Those beneficial effects were not manifested in this study.

The Speed Problem in Nashville

There are many problems confronting honest efforts to frame a realistic, reasonable and effective speed law. A driver with slow reaction time, in an overloaded vehicle with poor brakes, dirty windshield, smooth tires, should obviously limit his speed to a much lower rate than an alert quick-reacting driver of a lightly-loaded car with excellent brakes, clean windshield and new anti-skid tires. Obviously no one numerical speed limit could apply to these two cases with equal validity.

On the other hand, that same alert driver on the same road in the same car, should drive only perhaps one half as fast, or slower, at night when the road is wet. When the road is icy his reasonable speed is obviously slower yet. These are but a few examples of the fact that no numerical speed limit can possibly be satisfactory at all times, places and under all conditions.

Therefore, the only really realistic speed law simply stated is "that a driver shall operate at all times at a reasonable and prudent speed, taking due account of conditions and hazards." [6]

(Continued on page 62)

[4] Wiley, Matyas, Henberger, **Effect of Speed Limit Signs on Vehicular Speeds**, Dept. of Civil Engineering, University of Illinois, Urbana, Ill.

[5] Speed Zoning Committee on Speed & Accident, Street & Highway Traffic Section, National Safety Council, Chicago, Ill., 1938

[6] See Nashville City Council Ordinance No. 45-252, Art. V., Sec. 44 (a).

TABLE II

If: signs which stated	Were replaced by	Then: Change which occurred was as follows			Number of Studies	No. of Streets Counted
		Avg. Speed	Std. Dev.	% in Pace		
30 mph	34 mph signs	—0.5*	—0.3 mph*	+3.5%	6	2
30 mph	39 mph signs	+1.2	—0.2 mph*	+2.7	3	1
30 mph	no signs	—1.6	—0.1 mph*	+1.3	3	1
34 mph	39 mph signs	+1.0	+0.2 mph*	—0.5*	6	2
34 mph	no signs	—0.7	+0.2 mph*	—3.0	6	2
39 mph	no signs	—0.5*	—0.2 mph*	0.0*	3	1

*Insignificant

Predicting the Effect of Expressways on Adjacent Arterial Routes

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The paper discusses a traffic assignment routine which estimates the usage of a proposed expressway and develops anticipated traffic volumes on adjacent routes. The volumes on adjacent routes are subdivided into three groups:

(a) Short local trips and trips not considered in the assignment;

(b) Trips which will continue to use the existing routes;

(c) Trips going to or coming from the expressway.

The arrangement of input and output data is such that checks can readily be made on the consistency and reasonableness of the engineer's choice of existing and proposed routes.

The data processing procedure is outlined and an analysis and discussion of the results presented. The paper concludes by indicating a future revision of the program which would reduce the preparation of input data to the minimum possible, short of having the computer determine the choice of existing and proposed routes.

TRAFFIC ENGINEERS have long appreciated the need for evaluating the effect of proposed expressways on the existing road network. For the design of a well integrated system, the traffic on streets leading to and from expressway ramps and the traffic relief provided to paralleling routes should be estimated in addition to determining expressway volumes. At times the effect of the expressway on the adjacent streets can be the decisive factor in selecting a route location from several feasible alternates.

Various methods of dealing with this problem have been reported in the past.[1] For the most part, these were developed for area-wide studies involving home interviews and required the use of a large-scale computer. This paper describes a technique used in planning the relocation of Connecticut Route 25 in Bridgeport for the Connecticut State Highway Department. The procedure described is suitable for data obtained from roadside interviews and can be processed by a medium-sized computer.

The Concept of "Trip Tracing"

A common method of assigning traffic to a proposed route involves determining the required time and distance via the best existing route and the time and distance via the proposed route for trips between any two points.[2] This is normally done in the office working from maps showing the running speed and length of various sections of routes in the vicinity of the expressway. The engineer decides which route traffic will follow in making each trip and sums up the times and distances involved. It soon becomes apparent that if a record of these routes were kept, valuable information would be preserved.

In the study under discussion this was accomplished by first subdividing the arterial network in the vicinity of the expressway into legs on the basis of approximately equal volume, running speed, etc. It was found that about 200 legs connecting all the major intersections adequately defined the area. Thereafter, as the engineer routed trips over the best existing route (determined primarily by time and distance figures but dependent in part on such things as pavement condition, alignment and general attractiveness) he noted both the total time and distance for the trip and the legs (route sections) traversed. The same trip was then routed via the expressway, with the total time and distance involved and the legs used noted as the proposed trip.

Example of a "Trip-Trace"

Figure 1 shows a hypothetical layout of arterial routes in the vicinity of a proposed expressway. These routes have been subdivided into legs numbered 101, 102, 103, etc. The distance and running time required to traverse each leg are known for every section of the network. Assuming that the best existing route from Zone 1 to Zone 2 is that shown by the long dashed line and the proposed route is indicated by the short dashed line, the engineer would complete a traffic assignment input form for this trip in the manner illustrated in Table 1.[3] He would also complete a trip-trace form similar to that shown in Table 2.

Data Processing

After the data for all trips investigated had been entered on forms similar to Tables 1 and 2, the information in Table 1 was punched into cards and used as input to an IBM 650 electronic digital computer. For each input card a corresponding output card was produced containing the information indicated in Table 3.[4]

At this point a card was keypunched for each leg number listed in Table 2. This card contained the following information:

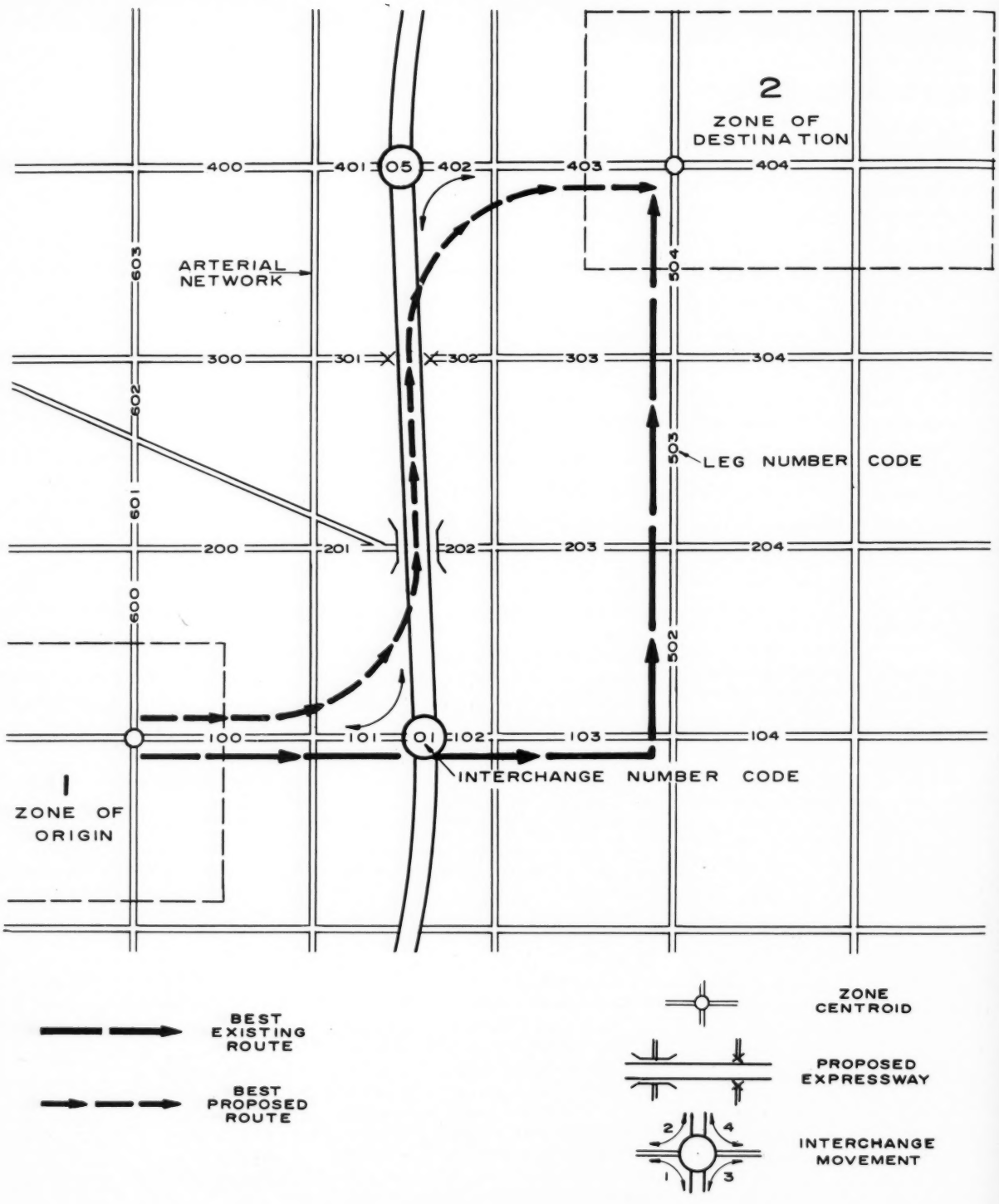
a) Serial Number
b) Origin
c) Destination
d) Leg Number

1. These methods are basically similar to those described by J. D. Carroll, Study Director of the Chicago Area Transportation Study at the 1959 meeting of the Highway Research Board.

2. See "California Method of Assigning Diverted Traffic to Proposed Freeways," Highway Research Board Bulletin 130— 1956.

3. All tables and forms shown have been simplified for purposes of clarity. Future design year factors were introduced into the actual study. This enabled all data processing work to be carried on concurrently for both present and future conditions.

4. In addition, summary output cards (not shown here) were also obtained. These summary cards furnished data for the geometric design of the expressway and cost-benefit information useful in comparing alternates. They were of the type normally associated with traffic assignment programs.



EXAMPLE OF TRIP TRACE

FIGURE 1

e) Code indicating whether leg was used during existing or proposed trace.

These cards were then matched with the detail output cards resulting from the computer run. If the leg had been used during the existing routing, the O-D volume remaining was transferred from the output card to the leg card. If the leg had been used during the proposed routing, the diverted volume was transferred from the output card to the leg card. This produced completed leg cards as shown in Tables 4 and 5.

Summary cards were then made up which totaled the various items shown in Tables 4 and 5 for each leg. The ADT volume for each leg as determined from traffic counts was then punched into these leg summary cards, completing all the data pertaining to each leg. This data is presented in Table 6.

TABLE 1

TRAFFIC ASSIGNMENT WORK SHEET

ZONE OF ORIGIN	ZONE OF DESTINATION	SERIAL NUMBER	O-D VOLUME	EXISTING DISTANCE	EXISTING TIME	RAMP ON	RAMP OFF	PROPOSED DISTANCE	PROPOSED TIME
1	2	001	100	3.2	12.8	012	053	3.0	10.4

TABLE 2

TRIP TRACE WORK SHEET

ZONE OF ORIGIN	ZONE OF DESTINATION	SERIAL NUMBER	EXISTING LEG NUMBERS							PROPOSED LEG NUMBERS						
1	2	001	100	101	102	103	502	503	504	100	101	402	403	–	–	–

TABLE 3

COMPUTER OUTPUT CARD

ZONE OF ORIGIN	ZONE OF DESTINATION	SERIAL NUMBER	O-D VOLUME	% OF O-D DIVERTED	VOLUME DIVERTED	VOLUME REMAINING

Analysis and Discussion of Data

The mere fact of listing the existing and proposed traces as shown in Table 2 almost insured that all routing would be done consistently. Any difference in opinion between engineers could easily be spotted by the checker and resolved. To determine whether the routings were reasonable, as well as consistent, a comparison was made between the ADT volume and the sum of O-D volumes on all legs. The O-D volumes should be somewhat smaller than the ADT volumes. The difference is due in part to short trips within the cordon area that do not pass through any interview stations and consequently are not picked up in the O-D survey. They are, however, recorded by volume counters. The remainder of the difference is made up of interviewed traffic not considered potential to the expressway. In cases where this difference appeared to be in error, traffic was rerouted until results were satisfactory.

The volume of traffic which would appear on any leg after the completion of the expressway was then computed from the data in Table 6 as follows:

1. ADT volume on leg minus the sum of O-D volumes on leg equals the numbers of short trips and non-potential trips which use the leg.
2. Add to the above trips the sum of volume remaining on that leg. (These are trips that continue to use the existing routes rather than the expressway.)
3. Add to the results of (2) the sum of volume diverted. (These are trips that use the leg either in going to or coming from the expressway.)

Step (3) gives the predicted ADT volume on any leg after the completion of the expressway.

The importance of having the components which make up the predicted ADT volume, as well as the total figure, should be stressed. For instance, assume that capacity studies show that a particular leg will be overloaded during the future design year. Inspection quickly reveals whether the overloading is caused by:

a) The increase in short trips and non-potential trips.
b) Not enough traffic diverted to expressway (remaining trips too high).
c) Too much traffic going to or coming from the expressway (diverted trips too high).
d) Any combination of the above.

If (b) is found to be the reason, a change in the location of the new expressway may be indicated. If (c) is the reason, relocation of interchange ramps may solve the problem; and so on.

It is also possible, by sorting and regrouping the completed leg cards (Tables 4 and 5), to determine which O-D combinations make up either the sum of volume remaining or sum of volume diverted on any one leg. This information could be very helpful in evaluating the results of changes in the O-D pattern, after the O-D survey has been updated at some future time. It could also be used to spot-check the probable effect of a large traffic generator constructed after the completion of the expressway.

Another benefit of knowing the components is that the sum of volume diverted on any leg may be multiplied by an induction factor to estimate the effect of induced traffic on the arterial routes as well as on the expressway proper.

Concluding Remarks

The trip-trace routine described was designed to utilize an existing traffic assignment program. This program is currently being rewritten to make the trip-trace routine an integral part of the traffic assignment. Time and/or distance volumes will be stored in the computer for each leg of the system, along with existing ADT volumes and induction factors. The engineer will

TABLE 4

COMPLETED LEG CARD – EXISTING ROUTING

ZONE OF ORIGIN	ZONE OF DESTINATION	SERIAL NUMBER	LEG NUMBER	O-D VOLUME	VOLUME REMAINING

TABLE 5

COMPLETED LEG CARD – PROPOSED ROUTING

ZONE OF ORIGIN	ZONE OF DESTINATION	SERIAL NUMBER	LEG NUMBER	VOLUME DIVERTED

TABLE 6

LEG SUMMARY CARD

LEG NUMBER	ADT VOLUME	SUM OF O-D VOLUMES	SUM OF VOLUME REMAINING	SUM OF VOLUME DIVERTED

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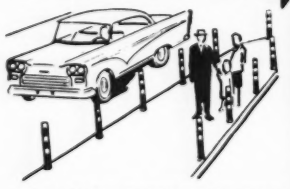

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then only have to supply as input the legs involved in the trip-traces. The computer would proceed automatically to the results described. This program revision should greatly reduce the time required to prepare input data.

It is recognized that the technique described here is restricted to the medium-sized assignment problems. It appears that areas requiring more than 300 legs or having more than 1500 actual O-D transfers potential to the expressway would be more efficiently analyzed using a minimum path concept, whereby a computer does the actual trip-trace.[5] For medium or small problems the method offers the advantages of having the engineer exercise more direct control over choice of route.

5. A description of a minimum path approach to traffic assignment is contained in the Armour Research Foundation Phase Report #1 to the Chicago Area Transportation Study, "Algorithm for Finding Shortest Paths Between Pairs of Points in a Network," June 1957.

WHAT IT TAKES TO MAKE THEM

To make all the route markers, directional, warning, and other signs for Ohio's 1,500-mile Interstate freeway program, estimates show these materials will be needed:

Steel (posts, standards, etc.)	2181 tons
Aluminum (sign blanks)	693 tons
Fasteners (bolts. etc.)	61,618 bolts

Training Opportunities

April 15-17—FREEWAY OPERATIONS SEMINAR

A seminar will be held at the Moraine Hotel, Highland Park, Illinois, under the sponsorship of the Midwest Section. Planners, engineers and enforcement officials who are or will be responsible for the planning, design or operation of controlled access facilities are invited. For reservation forms and further information, contact George Hagenauer, Illinois Division of Highways, 160 N. LaSalle Street, Chicago 1, Illinois.

April 20-22—FREEWAY OPERATIONS SEMINAR

A seminar will be held at the Town House, near Omaha, Nebraska, under the sponsorship of the Missouri Valley Section. Planners, engineers, and enforcement officials who are or will be responsible for the planning, design or operation of controlled access facilities are invited. For reservation forms and further information, contact Robert L. Meyer, Department of Roads, State Capitol, Lincoln, Nebraska.

May 11-13—FREEWAY OPERATIONS SEMINAR

A seminar will be held at Bear Mountain State Park, New York, under the sponsorship of the Metropolitan (N.Y.) Section of the Institute of Traffic Engineers. Planners, engineers, traffic enforcement officials and others who have or will have traffic operations responsibilities for freeways are invited. Attendance will be drawn primarily from the New York City metropolitan area, and the program will be slanted toward problems of urban freeways. For reservation forms and further information, address Gordon K. Gravelle, Deputy Commissioner of Traffic, 100 Gold Street, New York 38, N.Y.

June 8-19 — TRAFFIC ENGINEERING AND POLICE ENFORCEMENT COURSE—

This course is an annual one offered by the Ontario Traffic Conference, and is scheduled this year at Huron College, University of Western Ontario, London, Ontario, Canada.

June 18-20—FREEWAY OPERATIONS SEMINAR

A seminar will be held at the Eugene Hotel, Eugene, Oregon under the sponsorship of the Western Section. Planners, traffic engineers, design engineers, enforcement officials, and others having official responsibility for freeways (planning, design or operations) are invited. For reservation forms and other information, address F. B. Crandall, Traffic Engineer, Oregon State Highway Department, Salem, Oregon.

June 22-24—FREEWAY OPERATIONS SEMINAR

A seminar will be held on the campus of the University of California at Santa Barbara, California under the sponsorship of the Western Section. Planners, designers, traffic engineers, enforcement officials and others having responsibilities for freeway planning, design and operations are invited. For reservation forms and other information, address John W. McDonald, Auto Club of Southern California, Box 2890, Los Angeles 54, California.

Traffic News

Highway Safety Study Submitted to Congress By Public Roads

The highway safety study prepared by the Bureau of Public Roads in accordance with the terms of Section 117 of the Federal Aid Highway Act of 1956 has been submitted to Congress by Secretary of Commerce Strauss. The report, entitled "The Federal Role in Highway Safety," will be printed as House Document No. 93 and will be available from the Government Printing Office soon.

The 1956 Act directed the Secretary of Commerce to prepare this report, which would outline what action could be taken by the Federal Government in the highway safety field. The report as now presented states, "Direct projection of Federal authority into highway safety functions that have been the responsibility of state and local governments is concluded to be impractical and would only weaken state and local authority."

Two specific proposals for Federal action are made in the report. The first would establish an Interdepartmental Highway Safety Board within the Executive Branch of the Federal Government, headed by the Secretary of Commerce. Other members might include the Secretary of Health, Education and Welfare; the Secretary of Defense; the Chairman of the Interstate Commerce Commission, and the Chairman of the Federal Communications Commission. The President's Committee for Traffic Safety is suggested as a consultant and advisor to the Board, which would have two major functions: to coordinate Federal agency efforts in behalf of highway safety, and to encourage and assist cooperatively in the development and application of more effective official programs in highway safety at the State and local levels.

The second specific proposal is for a driver records clearance center, to be operated as a service to State motor vehicle administrators. By providing a central clearing house for all license suspension and revocation actions by States, it might be possible to make present driver improvement programs more effective. It is estimated that one million licenses are currently in revoked status, with the ever present danger that a State may inadvertently grant driving privileges which have been revoked in another State.

It is recognized in the report that the Federal Government has an important responsibility to the highway safety program. It is pointed out, however, that recent gains in highway safety are the result of a broad effort by official and private organizations. In general, the judgments formed over the years, and upon which safety programs have been based, are sound.

Other important findings and conclusions of the report are as follows:

- ...Federal assistance to traffic law enforcement is feasible in the form of research cooperation on police and court problems.
- ...The important work on uniformity of traffic safety laws needs increased support by the Federal Government and private sources.
- ...Motor vehicles are of a relatively safe design but more working cooperation between automotive engineering groups and government at appropriate levels would be beneficial.
- ...Traffic accidents are highest as a cause of death during the ages ranging from 15 to 24 years. Based on miles of driving, accident rates are high for drivers below 24 and over 65 years of age. A program of Federal assistance to the States and, through them, to local governments on driver training is seen to be desirable.
- ...Controlled-access highways are several times safer than ordinary highways and construction of the interstate system is expected to save 4,000 lives per year. Other modern design practices can provide permanent safety gains on the extensive mileage of highways where control of access is not feasible.
- ...More attention to localized hazards and application of modern traffic engineering techniques is warranted. The public interest requires extensive rehabilitation and renewal of traffic signing and marking on all important streets and highways.
- ...Excessive use of alcohol is found to be a factor in up to 50 per cent of fatal accidents.
- ...An association appears to have been established between crime rates, other antisocial behavior and accidents.
- ...Adequate understanding of the effect of human factors on accidents does not now exist. Intensive investigation of accidents and of the intricate process involved in driving offers hope for needed new knowledge in this area.
- ...The relation of speed to accidents is not a simple one. From studies on main rural highways, the accident rate was found to be highest at low speeds. However, extreme severity is associated with the higher speeds.
- ...Night accident rates are commonly double those of daytime. As vehicle speeds exceed 55 miles per hour, the night accident rates become relatively much worse. The most hazardous period is between the hours of 2 and 4 a.m.
- ...Accident rates occurring during the major holidays average 25 per cent higher than other periods, when related to the amount of driving. Christmas and 1-day holidays occurring in the middle of the week have the most serious records.
- ...Current accident reporting is both inaccurate and incomplete. Some exploratory work suggests the possibility of improved techniques for accident data tabulation and classification. In addition, the intensified cooperation of government and others is required to attain better quality, completeness and uniformity in the reporting itself, to the end that more useful and scientific analyses can be made.
- ...Total traffic accident costs average approximately 1 cent per mile of travel or a total of over 5 billion dollars in 1958. Research in one State on direct accident costs indicates that they amount to 0.43 of a cent per mile of driving. The division of this direct cost is 40 per cent for property-damage accidents, 57 per cent for injury accidents, and 3 per cent for fatal accidents.
- ...It would be in the national interest to create a mechanism for leadership, guidance and a degree of coordination in the areas of research,

development of standards, and specifications for highway safety. The major challenge to Federal action is the establishment of a favorable environment for conduct of State and local official highway safety activities. The strong incentive provided by the highway safety need and the intelligent, cooperative use of public funds will produce the best all-round accomplishment. Even a small reduction in accidents would warrant a considerable expenditure.

Yale Announces Combined Urban Planning and Traffic Engineering Program

A combined urban planning and traffic engineering program has been announced by Yale University. The program, which will lead to both a Master of City Planning degree and a Certificate in Highway Traffic, will extend over a period of two academic years. The first class will be enrolled in September 1959.

The integration of urban planning and traffic engineering disciplines is achieved by combining portions of the regular courses offered by the Bureau of Highway Traffic and by the graduate program in city planning.

The Bureau of Highway Traffic operates under the Committee on Transportation. Its objective has been the training of traffic engineers at the graduate level. The *normal* traffic engineering course of study offered by the Bureau extends over one academic year and leads to a Certificate in Highway Traffic. The city planning course of study is in the school of Art and Architecture. Its *normal* two-year program of graduate study leads to a Master of City Planning Degree.

The integrated city planning and traffic engineering curriculum combines courses in both areas of study which apply particularly to urban transportation and development problems. The combined course of study extends over a period of two academic years during which students will deal simultaneously with concepts and methods (both qualitative and quantitative) of city planning and traffic engineering.

The traffic engineering portion of the curricula is based on engineering disciplines. The phenomena of traffic as a foundation of scientific study are covered in the course in *characteristics and measurements*. The two methods employed to make traffic operations improvements are contained in the courses (1) *traffic regulation and control*, which is concerned with measures to increase the efficiency of traffic flow, and (2) *highway location and geometric design* which deals with the planning and creation of new highway facilities having inherent qualities of safety and capacity.

The city planning portion of the curricula is based on the concept that planning is the rational integration of the art and science of community development. The history and philosophy of planning are included in the courses (1) *introduction to city planning* and (2) *civic art*. Social science concepts of planning are covered by courses in (1) *urban sociology*, and (2) *housing*. Physical planning design, including the techniques employed, is contained in the courses (1) *planning theory* and (2) *planning research*. Courses in traffic administration, planning administration and the law of planning and zoning are designed to equip the student for administrative responsibilities.

To coordinate the principles and theories covered in all courses, students work individually and as committees to solve comprehensive traffic and urban planning problems. This phase of the course is covered by (1) *traffic problems workshop* and (2) *planning projects*.

To complete the requirements of the two-year program, each student is required to develop a thesis based on research indicating his capacity for advanced work. This research should be started during the first year of study. The combined staff of the traffic engineering and city planning courses will be available to advise and comment on this work.

To be admitted to the graduate course in urban planning and traffic engineering, a student must have reached an engineering degree from an accredited college. All applications for admission must be approved jointly by the Committee on Transportation and the Section of City Planning. In accepting students for enrollment, important consideration is given to the quality of work done in undergraduate courses and the aptitude of the student for broad scale work in urban transportation. It is essential for foreign students to have a thorough knowledge of the English language.

Applications for admission must be made upon blanks obtained from Miss Jeannette Nichols, Secretary to the Faculty in City Planning, School of Art and Architecture, Yale University, New Haven, Connecticut or Secretary, Committee on Transportation, Yale University, New Haven, Connecticut. Applications also must include four confidential statements to be furnished by previous employers and college professors familiar with the applicant's abilities; in addition, an official transcript of college courses and grades, including graduate work, if any, must be received from all colleges or universities the applicant has attended. May 1 is the deadline for applications.

Fellowships and tuition scholarships may be available to students with exceptionally high qualifications. The possibilities of financial aid can be determined only after application.

Bill Introduced In Congress on Navigational Clearances

A bill which many highway users are reported to be supporting as an acceptable solution to the problem of navigational clearance requirements for highway bridges has been introduced into Congress by Senator Francis Case (R., S.D.). The provisions of the bill (S. 1126) would have the effect of reducing the cost of highway and other bridge construction over navigable waterways.

The Case bill would require that Federal officials (1) recognize the equal rights of all forms of surface transportation; (2) evaluate the economic effect on all forms of surface transportation of the added cost of constructing the bridge with navigational clearances required, taking into consideration any conditions relating to maintenance and operation; and (3) take into account any special requirements for accommodation of Federally-owned defense vessels.

The problem of bridge clearances and drawbridges over navigable waterways has concerned highway users for a number of years because accommodating some water vessels has necessitated construction of more expensive structures than those which would otherwise be required to serve highway transportation. The matter was the subject of a resolution adopted at the Annual Meeting in Miami Beach (see TRAFFIC ENGINEERING for January 1959, page 42).

Freeway Operations Seminar to be Held In May for the New York Metropolitan Area

A Freeway Operations Seminar has been scheduled for the New York City Metropolitan Area in May, according to the Institute of Traffic Engineers.

The seminar will be held May 11, 12 and 13 at Bear Mountian State Park, Bear Mountain, New York. Attendance at the meeting will be principally from New York City and surrounding areas.

This seminar will be the ninth in a series started in 1958. All of the meetings, which are sponsored by the Institute of Traffic Engineers, are designed to acquaint engineers, planners and enforcement officials with the problems connected with the operation of controlled access facilities such as will be built in the Interstate Highway program.

Invitations will be extended to traffic engineers, planners, design engineers, enforcement supervisors and other town, county, park and state officials who will have responsibilities in planning or operating a freeway or expressway.

Discussions will be led by a team of engineers and police officers who have had experience with this type of highway.

Local arrangements for the Bear Mountain Seminar are in the hands of a committee headed by Gordon K. Gravelle, representing the Metropolitan New York Section of the ITE, and New York City. Further information may be obtained from him, or from the office of the Institute of Traffic Engineers, 2029 K Street, N. W., Washington 6, D.C.

Howard Pyle Elected President of NSC

Howard Pyle, since 1955 a deputy assistant to the President of the United States and former governor of Arizona, was elected president of the National Safety Council to succeed retiring Ned H. Dearborn.

As a presidential assistant, Pyle directed policy and liaison in the field of federal-state-local government relations. He was the planning contact man for the President's Committee for Traffic Safety and for the past 30 years has been in advertising and radio.

Insurance Industry Forms Safety Institute

The newly formed Insurance Institute for Highway Safety,with headquarters in Washington, D.C., will unite the efforts of the automotive insurance industry in promoting traffic safety.

The institute was formed by three major insurance industry groups, representing more than 500 automobile insurance companies—the Association of Causalty & Surety Companies, the National Association of Automotive Mutual Insurance Companies and the National Association of Independent Insurers.

Elected chairman was Guy E. Mann, of Aetna Casualty. Mann outlined the institute's program as consisting of two elements: (1) promoting action programs in cooperation with federal, state and local agencies and officials, both public and private; and (2) providing financial or other assistance for agencies or organizations conducting effective safety programs.

The Institute will operate with a $1 million annual budget.

Members of the board are: J. Harry Bibby, U. S. Fidelity & Guaranty; James Crawford, Indemnity of North America; Arthur S. Johnson, American Mutual Liability; Howard Hutchinson, Nationwide Mutual; Dwight M. McCracken, Liberty Mutual; Thomas C. Morrill, State Farm Mutual Auto; Chase M. Smith, Lumbermen's Mutual Casualty; Albert E. Spottke, Allstate, and Mr. Mann.

ASF Offers $2000 Fellowship At Michigan State

For the second year, the Automotive Safety Foundation of Washington, D.C. is offering a $2,000 fellowship for study in the field of highway traffic administration at Michigan State University.

The announcement of this year's fellowship grant was made by the M.S.U. Highway Traffic Safety Center and the School of Police Administration and Public Safety.

Applicants for the fellowship must have a bachelor's degree, high scholastic ability and work or school experience in the field of highway traffic and administration.

The fellowship is offered for master's degree work in the fields of traffic safety organization administration, safety and public information or related areas.

Applications should be sent to the Director, M.S.U. School of Polic Administration and Public Safety by June 1, 1959.

Last year the fellowship was awarded to Fred E. Vanosdall of Lansing. Vanosdall now is studying driver license administration in the M.S.U. School of Police Administration and Public Safety. He is on leave of absence from the division of driver and vehicle services of the Michigan Secretary of State.

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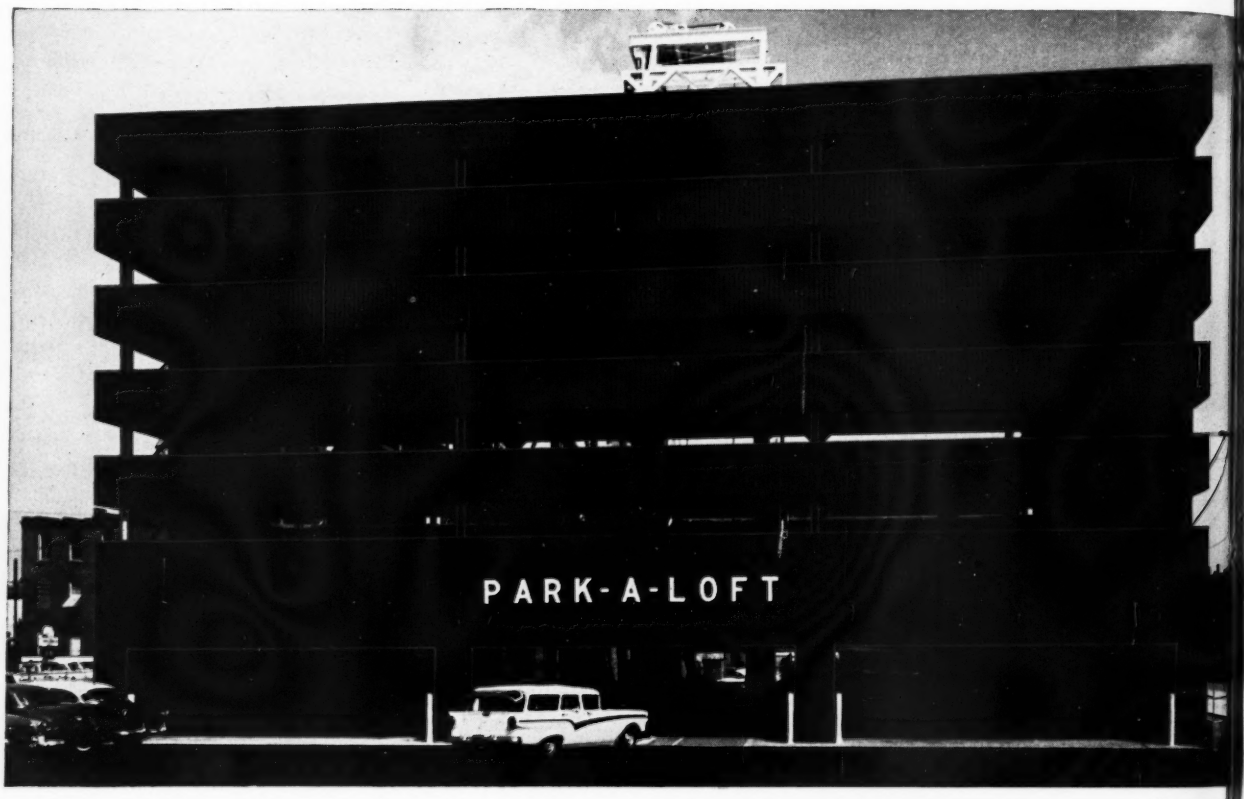

New 264-car Park-A-Loft at Parkersburg, West Va. Frank W. Gove, Jr., Mayor and Chairman of Parking Commission; Jesse D. Folwell, architect; Wilbur Smith & Associates, consulting engineers; Dresser-Ideco Company (Division of Dresser Industries, Inc.), general contractors.

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For the first time, a mechanical parking garage that produces first-floor income, takes traffic surges right off the street

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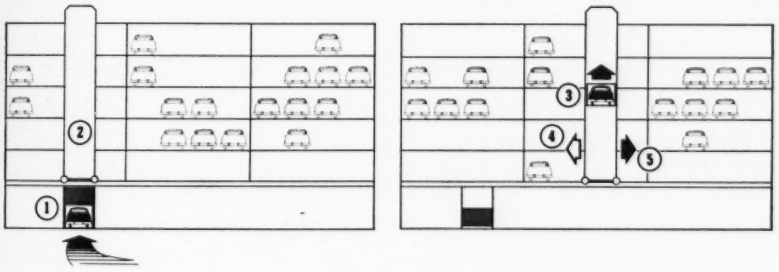
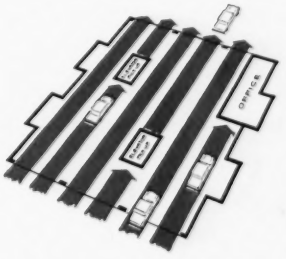


Park-A-Loft does 2 things at once (left) Car stops in front of elevator station on first floor (1), elevator tower (2) is in position overhead and elevator is on ground floor. Dolly picks up car, carries it onto elevator. (right) As elevator rises into tower (3), wheel-mounted tower **simultaneously** travels either left (4), or right (5) along face of the parking stalls. As tower travels, elevator within tower rises to selected level. At desired parking stall, elevator and tower stop; Park-A-Loft dolly carries car into stall and deposits it. Entire sequence of operations takes only seconds. De-parking operations are just the reverse.



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(left) **No hands.** Car dolly automatically adjusts to the correct length for the car being handled . . . lifts every make and model on rubber-covered pads at these 3 safe points — under both sides of front suspension frame and under differential. There's no metal-to-metal or metal-to-tire contact, no chance of operator error.

(right) **Easiest, safest way to park.** Dolly deposits cars in parking stalls. Right front wheel lock stops any movement. No space is wasted, there's no chance of damage to vehicles.

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New Appointments

McIntyre Elected President of Pittsburgh Motor Club

Lewis W. McIntyre (Member and Past President, ITE) was elected president of the Pittsburgh Motor Club at a meeting of the Board of Directors of the Club late in January. McIntyre will fill out the unexpired term of Mr. Park H. Martin, who has left Pittsburgh to become Pennsylvania Secretary of Highways.

McIntyre has been executive vice president of the Club since 1934, and a director since 1925. A graduate of the University of Pittsburgh, he had several years of highway construction experience and service as an artillery officer in World War I before becoming Professor of Highway Engineering at the University of Pittsburgh in 1918. He offered a course in street traffic control in 1922, believed to be the first of its kind.

In 1930, he was appointed traffic engineer of Pittsburgh. In World War II he served three years in the Mediterranean and European Theaters, holding the rank of Lieutenant Colonel. Active in engineering, safety and civic societies, McIntyre was president of the Institute of Traffic Engineers in 1934-36. He has also been president of the Pittsburgh Section of ASCE and a director of the Western Pennsylvania Safety Council.

JOB CHANGES

Robert Breuer—from the New York City Department of Traffic to the Department of City Planning, New York City, as Assistant Civil Engineer.

* * *

Benjamin M. Givens, Jr. — from the firm of Brown & Blauvelt in Woodbury, New Jersey, to the position of Traffic Engineer, Urban Planning, with the Pennsylvania Department of Highways at Harrisburg.

* * *

W. H. Gordon, Jr. — now City Traffic Engineer of Newport News, Virginia; was with the Virginia Department of Highways at Richmond.

Pennsylvania Names Froelich Deputy Sec'y And Chief Engineer

William R. B. Froelich (Associate Member, ITE) has been named Chief Deputy Secretary and Chief Engineer of the Pennsylvania Department of Highways by the new Secretary, Parke Martin. Froelich, who has been Executive Director of the Pittsburgh Parking Authority, thus becomes the chief technical man in the Pennsylvania setup.

William R. B. Froelich

Froelich became head of the Pittsburgh parking agency in 1952, after four years as chief planning engineer for the Pittsburgh Regional Planning Association, a citizens planning agency. Earlier he had served with two consulting firms, and during World War II with the Corps of Engineers in North Africa and Italy. He retired from active duty with the rank of Lieutenant Colonel.

A graduate of Carnegie Tech in civil engineering, Froelich also holds the Master of City Planning degree from M.I.T. and the Certificate in Highway Traffic from Yale. Licensed as a professional engineer in Pennsylvania, he has been active in ASCE as president of the Pittsburgh Section in 1957, as well as being a member of NSPE and ASPO.

van der Sanden Moves From Rotterdam To Nijmegen

Word has just reached the States that Police Inspector J. van der Sanden, known to a number of U. S. traffic engineers and police officers by virtue of an extended U. S. trip in 1957, has been appointed Chief Inspector i/c of Traffic for the City of Nijmegen, The Netherlands. Inspector van der Sanden was formerly in the Rotterdam Police Department.

Nijmegen, a city of 130,000, is near the German border. In his new assignment, Inspector van der Sanden will have responsibility for all phases of traffic control including enforcement and engineering.

TITLE CHANGES

Douglas S. Brinkley—is now Chief Engineer of Programming and Planning for the D. C. Department of Highways and Traffic in Washington; was formerly Planning Engineer.

* * *

Wilfred W. Davis—is Assistant Deputy Chief of the Standardization Branch, U. S. Army E. R. D. L., at the Engineer Center, Fort Belvoir, Virginia.

* * *

Joseph M. Galeota—is now Chief Traffic Engineer of the Boston Traffic Department; was Principal Traffic Engineer.

* * *

Joseph S. Marlow—was Acting District Traffic Engineer for the Michigan State Highway Department in Detroit; is now Metropolitan District Traffic Engineer.

* * *

D. W. McKenzie—formerly Traffic Engineer with the Sacramento County Highway Department; is now Highway Engineer in charge of the Design Division.

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1958 PROCEEDINGS

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JOHN W. ZIMMERMAN

John W. Zimmerman (Associate Member, ITE) died suddenly on February 26, following a heart attack. At the time of his death, he was Engineer-Manager of the Calumet Skyway in Chicago. He was 45 years old.

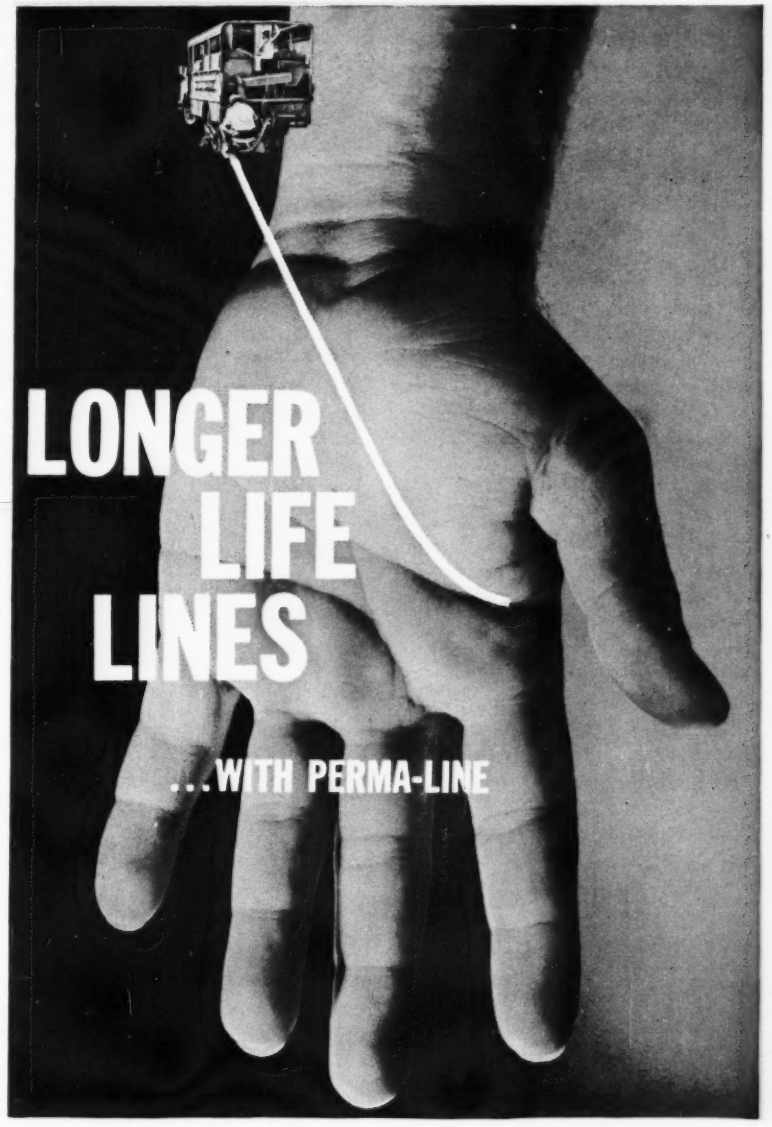
A graduate of the Illinois Institute of Technology, Zimmerman spent his entire professional career in the traffic engineering field. In 1935 he started with the Chicago Park District, and was instrumental in many of the major developments of the Park District's boulevard system. From draftsman he rose through the ranks to the position of assistant traffic engineer.

In 1941 he entered the Army and saw service in the ETO as traffic control officer for General Patton's Third Army. Later, with the rank of Captain, he served as traffic Engineer for the Third Army after the cessation of hostilities.

In February 1958, Zimmerman left the Park District to become the first director of the City of Chicago's Calumet Skyway, the toll facility linking Chicago with the Indiana area just to the southeast. As the Engineer-Director, he directed the operation, which was opened to traffic in April 1958.

Zimmerman was active in Midwest Section affairs, serving in various offices until 1958 when he was President.

Surviving are his widow and thirteen-year-old son, John Junior.



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New Publications

Basic Issues In Chicago Metropolitan Transportation

Northwestern University Transportation Center, 1818 Hinman Avenue, Evanston, Illinois. $3.50.

The purpose of the study is to identify and analyze the basic issues in Chicago Metropolitan transportation—thus contributing to the development of sound public policies.

In the preparation of the study, made for the Chicago Central Area Committee and the Chicago Association of Commerce and Industry by the Transportation Center at Northwestern University, the following questions were raised and discussed:

1. What is the extent of public responsibility for transportation in the area, should this be vested in one or in several agencies, and in what way should such agency or agencies be made responsible to the electorate?
2. Should private transportation companies (suburban railroads, bus lines, taxis) be subject to the manner and kind of regulation on entry, abandonment, service and price which they are now subject to under state and local laws?
3. Should the Chicago Transit Authority, or any other common carrier (public or private), be given public funds or facilities paid for by public funds to augment its revenues from fares?
4. Should costs of the highway system be paid for completely by user charges (license fees, wheel-taxes and motor fuel taxes) or should general tax sources also be utilized?

The two appendices give detailed information on:

- The Demand for Mass Transportation in the City of Chicago
- The Contribution of Motor Vehicle Users to the Cost of Highways and Streets in the City of Chicago

The study, "Basic Issues in Chicago Metropolitan Transportation," was written by Edwin T. Haefele, Assistant Director of the Transportation Center.

Parking Dimensions—1959 Model Cars

Automobile Manufacturers Association, New Center Bldg., Detroit, Michigan. 1959. 8pp. Free.

The Automobile Manufacturers Association has compiled again the dimensions of current model automobiles for use by parking garages, garage builders, and street and highway departments.

To be useful and not too bulky these dimensions are given as a range of the various models for each make for each of the items measured. These measurements may or may not match. For example, the wheelbase of one make ranges from 122 inches to 126 inches. However, the car with the shortest wheelbase may not be the shortest in overall length; similarly, the longest in wheelbase may not be the longest in overall length.

The range of specifications covers sedans, coupes and station wagons. Special extended wheelbase models are normally excluded.

Dimensions are normally taken with car in loaded position ("design load"), including five passengers, using a load of 300 pounds in the front, and 450 pounds in the rear; also includes spare wheel, tire and tools, gas, oil, water and with tire inflated to recommended pressure.

Height of a car unloaded ("curb weight") but with spare tire and tools, gas, oil, water and with tires inflated to recommended pressure can be as much as three inches higher than with five passengers.

Street Barricading and Channelization Manual for Temporary Traffic Control

Traffic Engineering Division, Public Works Department, Phoenix, Arizona. 24 pp.

This manual was prepared to outline proper traffic control methods for all public and private organizations to follow when temporary disruption of street traffic is required for street repairs or work on utilities under a street in Phoenix.

In addition to purely local matters such as the proper procedure for obtaining permission to work in the street, the manual covers materials and personnel needs for barricading and channelizing traffic, including cones, barricades, warning lights, flagmen and policemen. A section is devoted also to types and methods of signing, and this is followed by examples of various types and locations of street work and the recommended treatment for each. The manual is well illustrated.

Cities In The Motor Age

By Wilfred Owen. The Viking Press, 625 Madison Avenue, N.Y.C. February 1959. 170 pp. and index. $3.95.

Wilfred Owen, transportation economist for the Brookings Institution in Washington and consultant to the Port of New York Authority, was an active participant in the Hartford Conference held some months ago to discuss new problems of urban areas, particularly in relation to the new highway program. This volume is his effort to summarize and evaluate the meeting. It is not a report on the Conference—but rather an attempt to put the discussions into a reasoned perspective.

Mr. Owen points out that part of the present difficulty is a matter of balance—or rather a lack of balance—between the road program and other areas. He says that it is not that we are spending too much on roads (only two per cent of the gross national product), but that we are spending too little on other items, such as new housing, better schools, slum clearance, transit modernization and all the rest.

The highway program alone is not the answer to the transportation problem, he says, and we need a coordinated transport system using all forms

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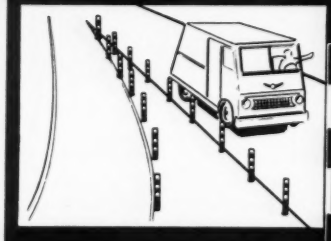

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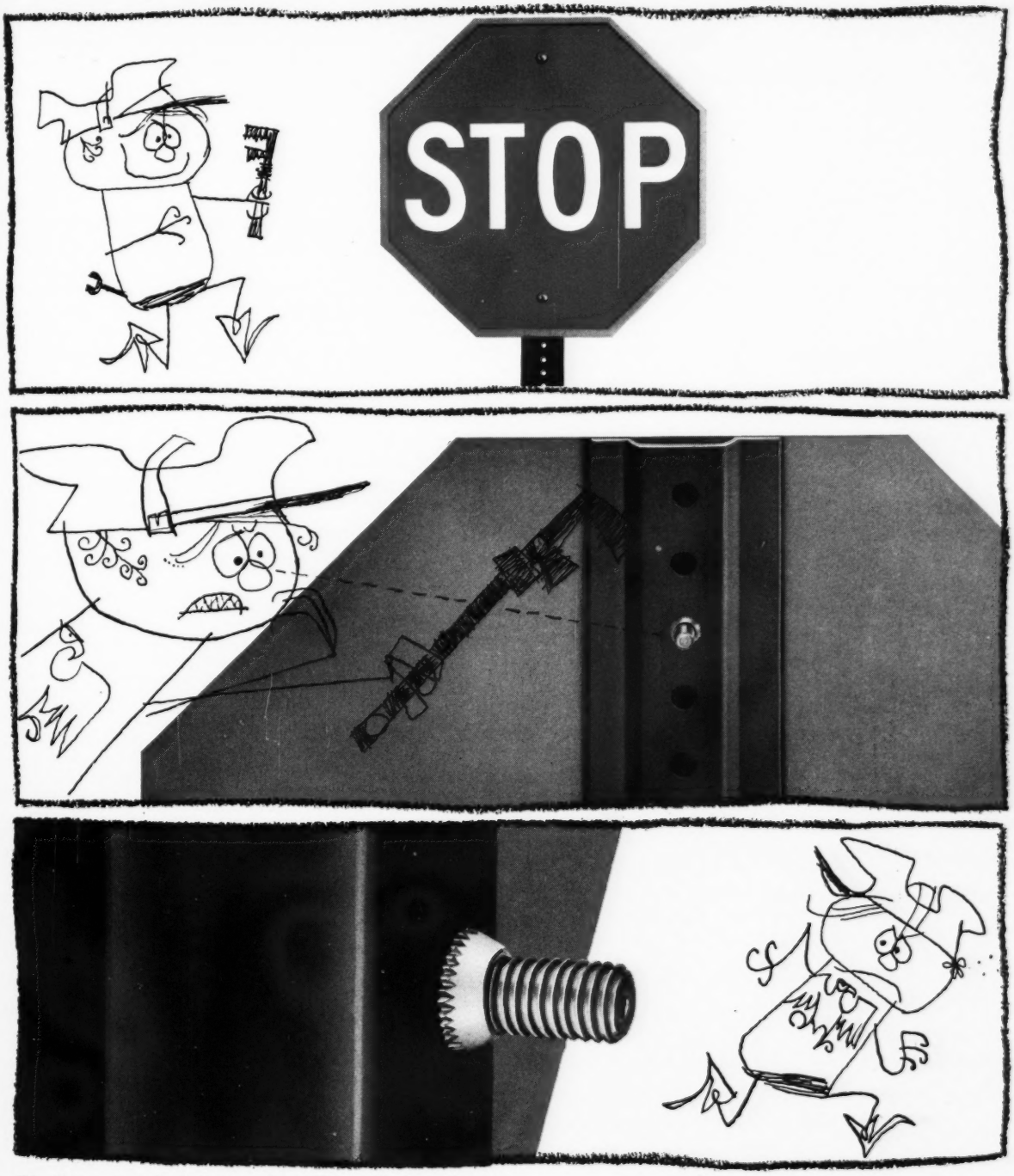

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—including rapid transit on rails and commuter railroads. He cites the absence of an overall metropolitan development strategy as a major defect in the nation's urban economy. The missing element is agreed-upon goals for the urban community.

The volume is written principally for laymen, but the professional will find it appealing as well. It will be especially interesting to those who felt the Hartford Conference was inconclusive and who were disappointed at the seeming conflict between planners and highway engineers. Mr. Owen has developed in his volume the type of discussion and conclusions which many expected from the Conference itself but which did not appear in very definite form.

Coming Events

April 14-16—MICHIGAN SAFETY CONFERENCE
Civic Center, Lansing, Michigan. Contact: Gordon H. Sheehe, Highway Traffic Safety Center, M.S.U., East Lansing, Mich.

May 10-14—AMERICAN SOCIETY OF PLANNING OFFICIALS—
Annual Conference, Hotel Leamington, Minneapolis, Minn. Contact: ASPO, 1313 East 60th Street, Chicago 37, Ill.

May 13 & 14—MISSOURI TRAFFIC ENGINEERING CONFERENCE—
11th Annual Traffic Engineering Conference, University of Missouri, Student Union Bldg., Columbia, Mo. Contact: Leon W. Corder, % State Highway Department, Jefferson City, Mo.

May 27-29 — ONTARIO TRAFFIC CONFERENCE CONVENTION—
Legion Memorial Hall, Sudbury, Ontario. Contact: R. F. Anderson, 2001 Eglinton Avenue, East, Scarborough, Ontario, Canada.

June 10-13—NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—
Annual Meeting, Commodore Hotel, New York, N. Y. Contact: NSPE, 2029 K Street NW, Washington 6, D.C.

September 7-11—ILLUMINATING ENGINEERING SOCIETY—
National Technical Conference, Hotels Fairmont and Mark Hopkins, San Francisco, California. Contact: IES, 1860 Broadway, New York, N. Y.

September 14-17 — INSTITUTE OF TRAFFIC ENGINEERS —
29th Annual Meeting, Commodore Hotel, New York, N. Y. Contact: ITE, 2029 K St. N.W., Washington 6, D. C.

September 20-24 — AMERICAN TRANSIT ASSOCIATION—
Annual Meeting, Hotel Leamington, Minneapolis, Minn. Contact: ATA, 355 Lexington Avenue, New York 17, N. Y.

October 11-16 — AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS—
Annual Meeting, Hotel Statler - Hilton, Boston, Massachusetts. Contact: AASHO, 917 National Press Bldg., Washington 4, D.C.

October 19-22 — INTERNATIONAL MUNICIPAL SIGNAL ASSOCIATION—
Annual Conference, Stardust Hotel, Las Vegas, Nevada. Contact: IMSA, 130 West 42nd St., New York 36, N. Y.

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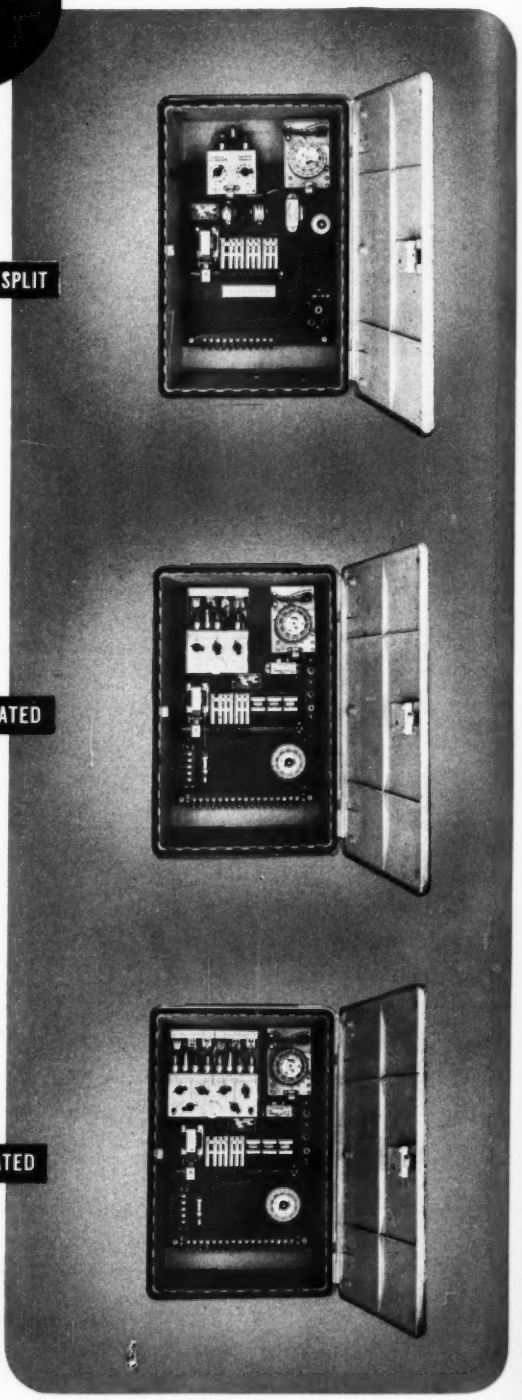

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MODEL 102V-CX Controller combines characteristics of both pretimed and actuated controllers. The cycle is continuous and synchronous. The program split is controlled by vehicle actuation. This permits complete coordination with progressive systems maintaining controlled rate and volume conditions in addition to providing a flexible Band Spread through direct vehicle control during EACH cycle.

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Strictly Business

Pyrex Glass Refractors Made by Corning New on the Market

Street lighting refractors of heat resistant Pyrex Brand glass are now available from Corning Glass Works.

Development of the refractors, which virtually eliminate the danger of thermal breakage, is in line with the trend toward lamps of increased wattage and higher levels of illumination. The refractors can be kept small and compact, yet have the strength to withstand the greater heat generated by high wattage lamps.

The company announced that it is making specially designed refractors of Pyrex Brand glass for both the General Electric Company and Westinghouse Electric Corporation.

The GE #500 refractor for its "R" IES Type III incandescent optical assembly is now being made of the high-strength, low expansion borosilicate glass. The refractor is being used with lamps up to 620 watt, 10,000 lumen size.

Two different Pyrex refractors are being made by Corning for Westinghouse's OV-35 series. One is for the clear mercury lamps in the 700 and 1000 watt sizes. The other is for color corrected mercury lamps in the 400, 700, and 1000 watt sizes.

New Report Issued On Downtown Malls

A new report on "The Impact of the Mall on Downtown" has just been published by Downtown Idea Exchange.

According to Laurence Alexander, General Manager of Downtown Idea Exchange, the downtown mall concept is the most talked about idea in downtown revitalization today. At the same time it is a subject on which downtown businessmen and civic officials have had little factual material to guide their thinking. This new report aims to supply those facts.

"The Impact of the Mall on Downtown" covers the history and development of the mall idea, the "pilot" and promotional malls being tested in several cities. And it thoroughly covers what many cities ranging from small to very large are doing and planning to create traffic free pedestrian malls in their downtowns.

Copies of this 12-page report are available at $2.00 each from Downtown Idea Exchange, 125 East 23rd Street, New York 10, N. Y.

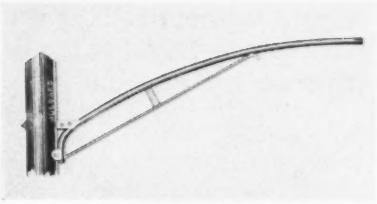
Downtown Idea Exchange is an independent organization devoted to redeveloping and promoting downtown areas of our cities. It publishes the twice-monthly newsletter on downtown improvement titled *Downtown Idea Exchange* and does consulting work in downtown promotional planning, public relations and business oriented research.

Reynolds Publishes Drawings and Specs For Bridge Railings

A printed folder containing complete drawings and specifications on aluminum bridge railings and accessories has been published by Reynolds Metals Company.

Of special interest to highway and construction engineers, the 26 separate drawings are printed on tracing paper for convenient use.

Copies are available on letterhead request to Reynolds Metals Company, Dept. PRD-5, Box 2346, Richmond 18, Virginia.



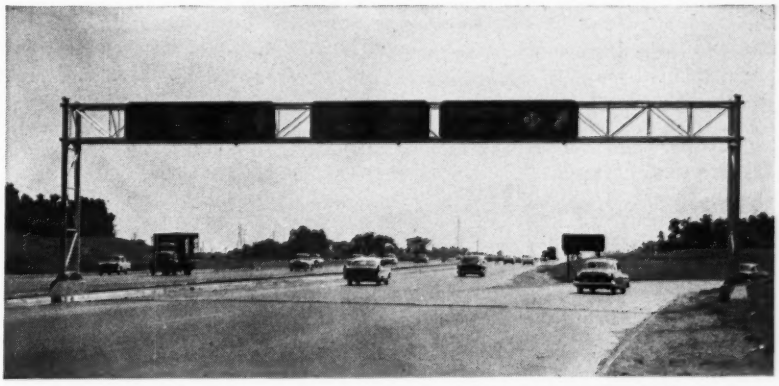
Street Light Bracket Redesigned by Hubbard

Hubbard and Company's most popular street light bracket, the round brace type No. 23208, has been improved by the addition of a flat steel supporting strut between the pipe and round brace.

The greater strength thus provided the bracket makes it ideally suited for use with 400 watt mercury vapor luminaries with built-in ballasts, according to the manufacturer.

This eight-foot-long round brace street light bracket of galvanized steel meets all E.E.I. requirements for Specification TDJ-137. It is designed for attachment to wood poles, or metal poles by using bands.

For further information write Hubbard and Company, 200 South Michigan Avenue, Chicago 4, Illinois.



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Planet Corporation, a leading supplier of engineered handling systems and automated machinery, is expanding its sales area for its overhead and roadside sign structures. Planet all-aluminum sign structures are expertly designed by experienced engineers. They will withstand hurricane-force winds, can be erected with minimum traffic interference, and eliminate maintenance costs. Planet sign structures are in use on highways in Michigan and Kentucky, and are under construction in others.

Now Planet needs representation in a number of states for this profitable line. If you would like to become associated with this progressive, growing company on either a full or part-time commission basis, write: Personnel Director, Planet Corporation, 1842 Sunset Ave., Lansing, Michigan.

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New Automatic Parking System Offered by Parcoa

The Parcoa Division of Johnson Fare Box Company, 4619 N. Ravenswood Avenue, Chicago 40, has announced a new coin operated automatic parking system.

This new off-street controlled parking system, the manufacturer says, provides the answer to many and varied parking problems—eliminates the need for either attendants or meters. The automatic gate is operated by electronic controls which are activated by the insertion of a coin or coins into the coin slot. The coin collector adjusts to any rate from 5¢ to $1.35 and can be coin or token operated. The coin box features a self-locking cash vault and a capacity counter to assure a parking space for all customers. Gate is closed by car passing over treadle. The manufacturer states that the system will pay for itself in a few months depending on lot capacity and traffic conditions.

Disney's Film 'Magic Highway, U.S.A.' Now Available

With the highway problem a matter of interest to more and more people, Walt Disney's 16mm release of Magic Highway, U.S.A. is a matter of personal intrest to traffic engineers and every other American who drives.

In 29 minutes, using Technicolor and all the techniques at his disposal, Disney transforms a factual subject into absorbing entertainment. The film offers a history of the American road from its crudest beginnings, an analysis of its current chaotic state and a breathtaking view of its future.

Rare movie footage dating back to the turn of the century has been exhumed from archives to highlight the historical section. In contrast to this are the brilliant animation sequences depicting possible highway developments in the years to come. Foreseen as entirely possible for the future by today's highway experts are such exciting possibilities as radiant heating systems buried in pavement to keep it dry during rain and ice conditions, quick drying ceramic surfacing material permitting use of pavement the same day it is laid, air-conditioned tubular highways spanning deserts, colored traffic lanes, cantilevered highways projecting into space from sheer mountain walls and a procession of other visions from the practical minds of practical men.

Magic Highway, U.S.A. is available for daily rental or long term lease. For information as to nearest source, contact 16mm Film Division, Walt Disney Productions, Burkank, California.

Flex-O-Guides Offer New Approach to Traffic And Parking Problems

A new product designed to guide and channelize vehicles on trafficways and in parking lots has been put on the market by a Chicago manufacturer, the Flexible Safety Zoning Company.

Called Flex-O-Guides, the product consists of a 26-inch length of extruded rubber tubing, standing in a vertical position on a cast iron base to which the rubber is chemically sealed. The vertical post is coated in alternating yellow and black bands for visibility. The base may be held firmly in place on the pavement by means of a cold mastic, easily applied.

The manufacturer suggests that the product is useful in every phase of traffic delineation on highways, particularly where clearances are not great and a rigid type divider might cause accidents. Highly visible, the devices are so flexible that they may be struck by vehicles without damage.

Flex-O-Guides are being distributed by Bell and Gustus, Inc., 4328 Elston Avenue, Chicago 41, Illinois. Prices and other information will be furnished promptly upon request from readers.

Capitol Selects Wayne Sweeper

Wayne Manufacturing Company has recently delivered a Wayne Model 706 to the United States Capitol Building in Washington, D.C. Illustrated above, this model is designed to sweep up to 120,000 sq. ft. per hour, indoors or out.

Wayne sweepers range in size from 30″ to 72″ and are powered by LP gas, electricity or gasoline. All Wayne sweepers incorporate the exclusive filter-vac dust control system which completely eliminates the old-fashioned dust bag and provides the ultimate in dirt-free sweeping.

Wayne Power Sweepers feature heavy steel wrap-around bumpers, hydraulic dumping, full vision, compact design and high maneuverability. Every feature is safety tested to provide the utmost in design and performance, according to the manufacturer.

Wayne Power Sweepers can be found the world over and have become a familiar sight in operation at municipal parking lots, city parks and recreation centers, civic centers, municipal airports and other installations where the public is accommodated.

For more information about Wayne Power Sweepers write to Wayne Manufacturing Company, 1281 East Lexington Avenue, Pomona, California.

NOTICE

Effective March 1, 1959 the subscription rate for TRAFFIC ENGINEERING magazine is $4.50 a year (foreign postage $1.25 extra).

Increased operating expenses are responsible for this price rise. We wish it were not necessary, but we will point out that it is the first increase since 1949.

—the Editors

Technical Notes

SIGNAL MAINTENANCE

By W. H. Mann
(Mem., ITE)
City Traffic Engineer
Nashville, Tennessee

FOR MANY YEARS signal lamps were replaced in Nashville as they burned out. But as the signal system grew and the number of lamps per intersection increased, the man hours required just for lamp replacement spiralled. It got to the pont where a crew with a ladder truck took a good part of the work day for replacements. But there were also many night emergency calls. Something had to be done about it.

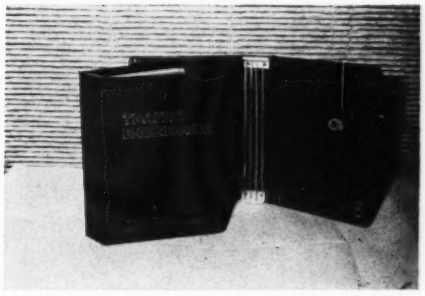
At that time, several years ago, a number of longer life lamps were produced. We experimented with several of these, but results were slow in accumulating, and not conclusive, except that a longer life lamp in itself was not the answer if replacement was to continue on an individual basis.

It became evident that we needed to clean signals more often than we were doing in order to maintain the proper brightness, and that if we cleaned properly at frequent enough intervals, group relamping could be done at the same time for almost no extra labor cost beyond the cleaning. We could also cut down on the large labor cost and truck running time involved with individual replacement, to say nothing of night emergency calls.

In the long interval during which we were trying to evaluate the problem and come to a solution, we kept accurate records of burnouts. When these were tabulated, they showed an unexpectedly wide variation in the optimum interval between group relampings. We have arrived at intervals varying from six months to eighteen months. The reason for this is in slight variations in line voltage. Near substations, where voltage is high, lamp life is much shorter than in some outlying sections where line voltage has dropped a little. In fact some intervals could have been longer than eighteen months but this was adopted as an absolute maximum between cleanings even in outlying areas.

We are using a standard 6000 hour lamp with rated voltage of 125 to get the above lamping schedule. It might

By Popular Demand



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This traffic tally board was designed by the traffic engineers of a large eastern city, and produced by them for their own use.* 3 Vary-Tallies on each side of the board count and classify all traffic entering intersections from any direction. Positive action of the large finger-keys makes it easy for operator to keep up with heaviest traffic flow.

Veeder-Root makes the Vary-Tally in any combination up to 6 banks high and 12 units wide . . . also in single units. All counters in one bank are reset by one turn of one knob. See how Vary-Tallies can help in *your* traffic-control problems. *Write.*

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Heavy Duty: 28" High, Sign 18"x18"; Thruway: 41" High, Sign 24"x30". Other models available. Also a wide variety of sign legends. Stands are of rustproof, galvanized steel with baked enamel finish for long life.

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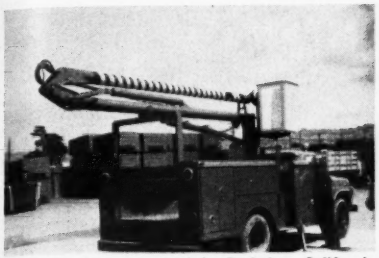


Hydraulic boom as used in Berkeley, California for overhead work.

be argued that maintenance could be lessened by using an 8000 hour lamp. But we feel that the minimum interval of six months which we are using is as long as signals in the downtown area should go without cleaning. Added lamp life with its premium cost would serve no purpose for us as the 6000 hour lamps will go six months per lamping.

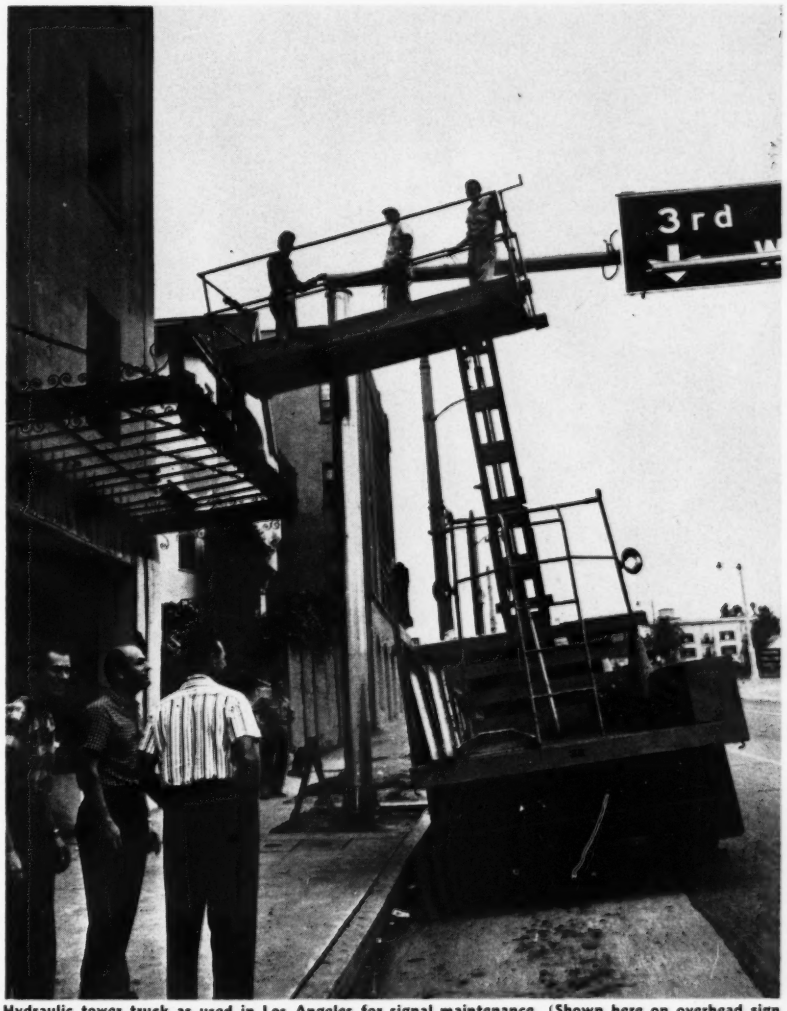
After the experience related here, we were interested in comparing our conclusions with those of others. Also, by bringing together information and experience from the field in general, we thought perhaps we could be of some help to those who might still be grappling with the problem. Hence, we sent out a questionnaire covering practice in signal maintenance.

We sent the questionnaire to one hundred and twenty-four traffic engineers. Replies were received from ninety-four. Of these, fifty-three are using group relamping and forty-one are using individual replacement. No definite pattern of any kind was discernible in the replies. Both large and small cities use individual replacement. Both large and small cities use group replacement. There is a weighting in favor of individual replacement by the larger cities, however. Of twenty-four cities over 400,000, fourteen are using individual replacement and ten are using group replacement.

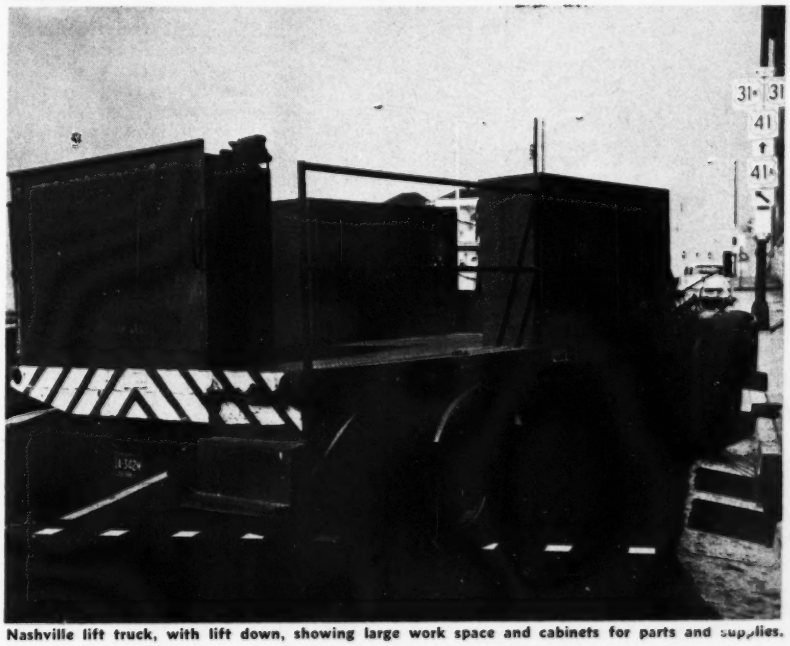
Only six cities contract their signal maintenance. Of these only one does group replacing — the city of Reno, Nevada.

For corner post-mounted signals the universal method for servicing is to use a short ladder by a man on foot. For those with overhead signals, either mast arm or span wire, there is a variety of equipment used. Most commonly used is the conventional aerial extension ladder.

Several use a hydraulic tower truck. This provides space for two men to work at a convenient height but does not put material bins and supplies into



Hydraulic tower truck as used in Los Angeles for signal maintenance. (Shown here on overhead sign erection.)



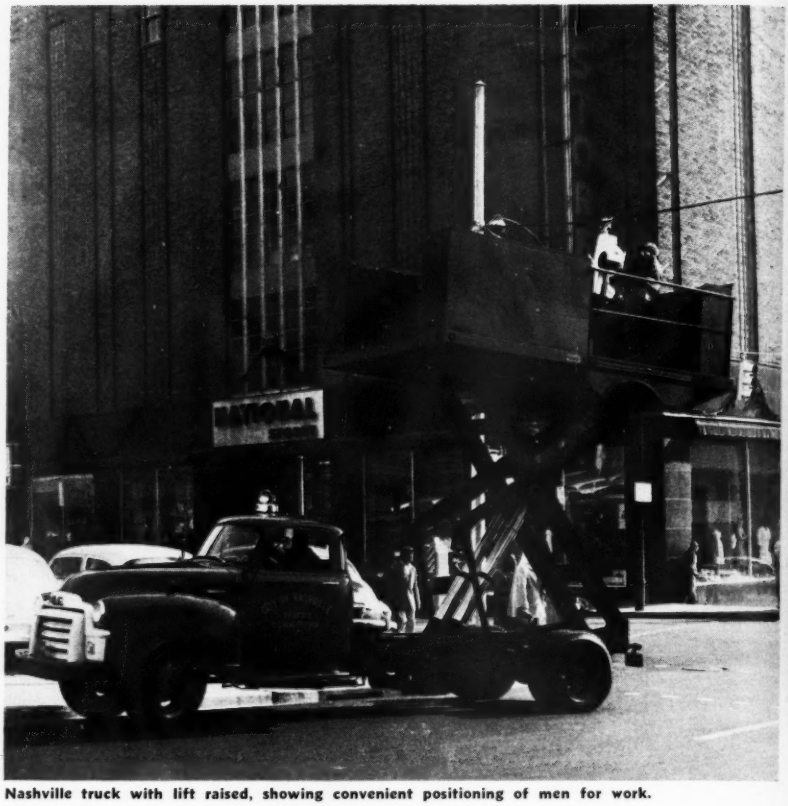
Nashville lift truck, with lift down, showing large work space and cabinets for parts and supplies.

convenient position except those that are carried on the floor of the tower. A hydraulic boom is also used. This has greater flexibility of adjustment in getting one man into working position but has the same disadvantage as the aerial ladder as far as having materials at hand, or in providing space for more than one man.

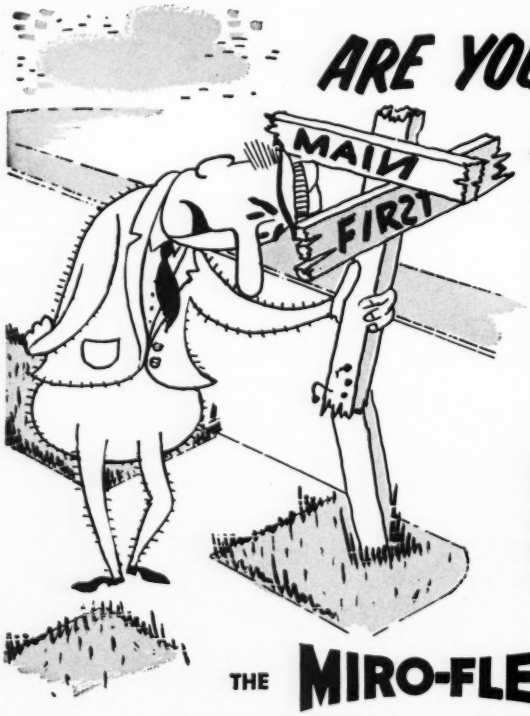
In order to do cleaning and relamping on a group basis in Nashville, we designed and had built a special truck for the purpose. Using a one and a half ton chassis, we mounted a hydraulic lift on it with a body designed for carrying all that is needed for cleaning, lamping and minor signal repairs. Two men on the truck have everything at their elbow to work with and can clean and lamp a four face head in a very short time. A third man is used to drive the truck and operate the lift. The truck has a vertical reach of fourteen feet so that all mast arm or span wire signals can be worked on at a convenient height.

Our special truck has proven to be a great labor saver. It puts two men to work on a signal under ideal conditions for production at a convenient working height and with everything

(Continued on page 62)



Nashville truck with lift raised, showing convenient positioning of men for work.



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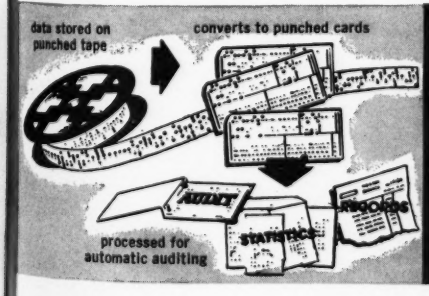

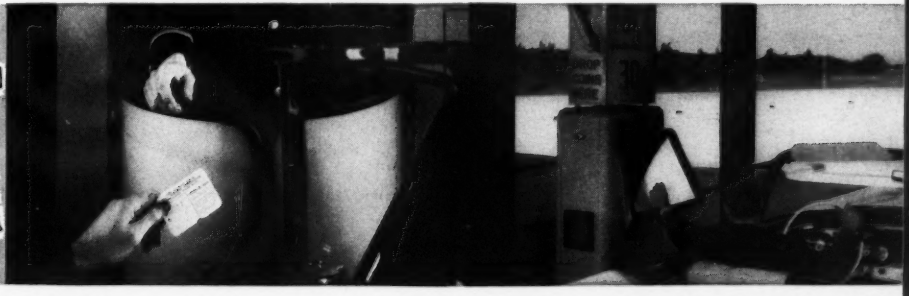

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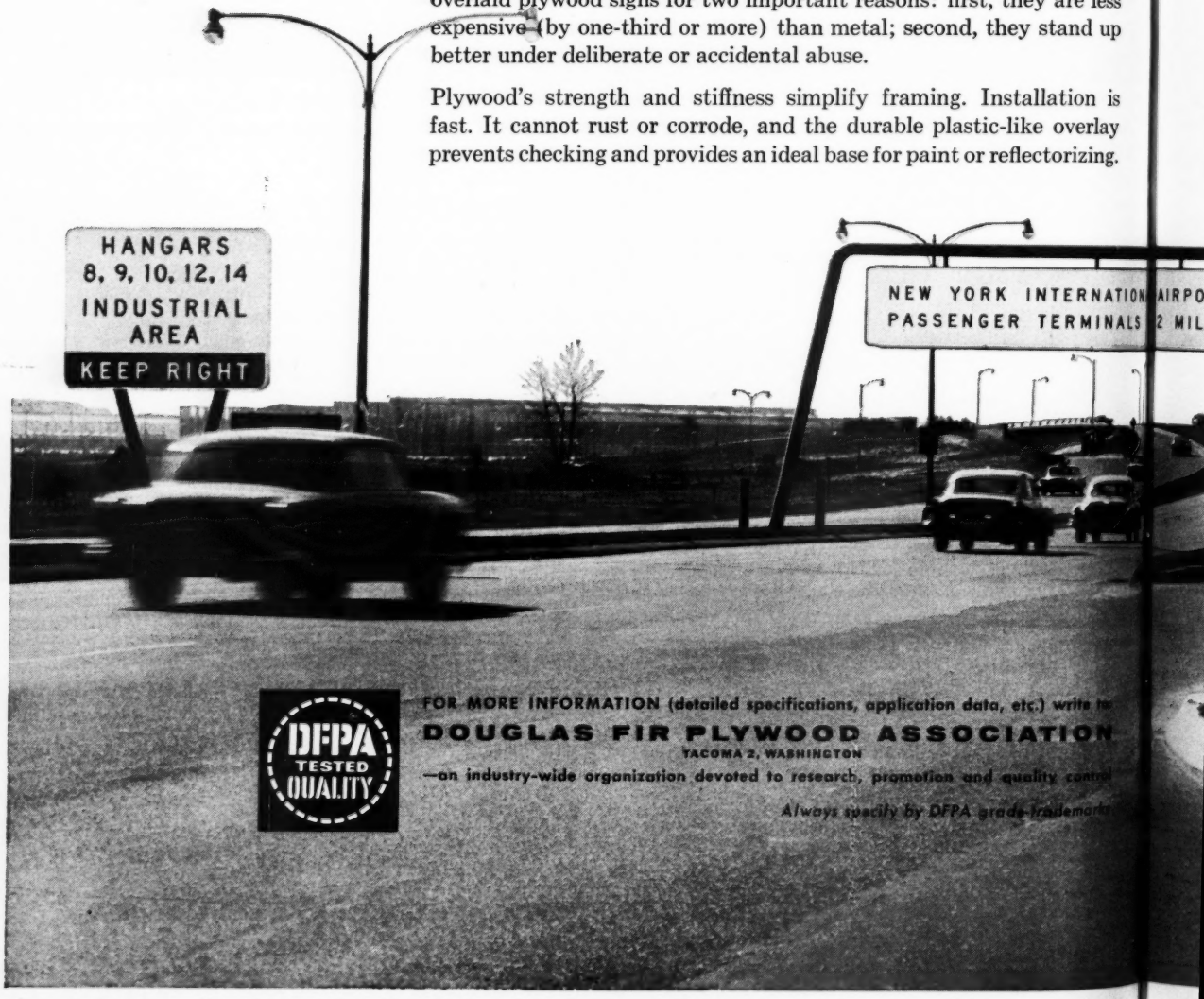
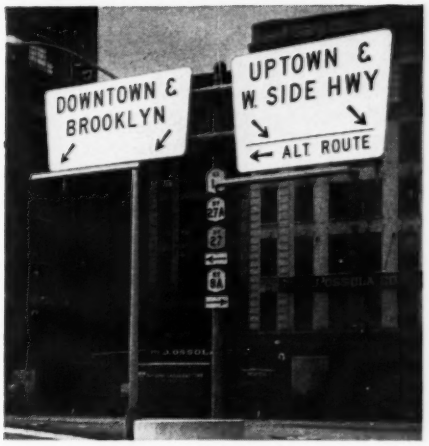


direct traffic at facilities



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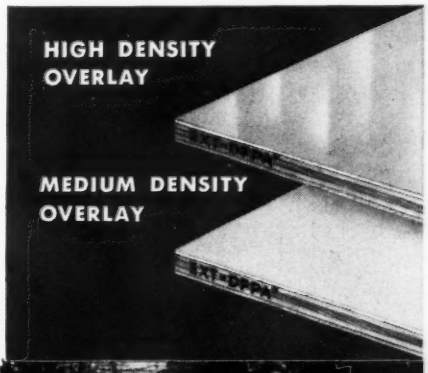

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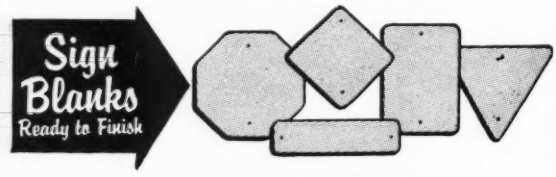

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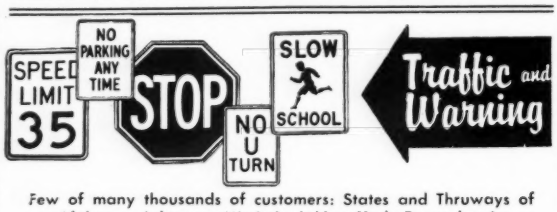

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Yearbook Changes

ANDREWS, Basil R. (Associate)
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BAHN, Adolph, Jr. (Associate)
Associate, Parsons, Brinckerhoff, Hall & Macdonald, 165 Broadway, New York 6, New York, BEekman 2-6300

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P. O. Box 2270, Tucson, Arizona

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GROVES, Alvin L. (Junior)
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GUTHRIE, Lt. Col. James R. (Associate)
Chief, Technical Intelligence Branch, Headquarters, U.S.A. Transportation Terminal Command, Pacific Fort Mason, California, PRospect 6-2200, Ext. 263. SEND MAIL: 651 Panorama Drive, San Franciso 27, California

HOOVER, Keneth M. (Associate)
Chief Engineer, San Francisco Bay Rapid Transit District, 870 Market Street, San Francisco 2, California, YUkon 2-9838. SEND MAIL: Apt. 1601, Bellaire Apartments, 1101 Green Street, San Francisco, California

JOHNS, Kenneth B. (Associate)
Assistant Director, Division of Traffic, Kentucky Department of Highways, Frankfort, Kentucky, CApitol 7-6263

KASK, Mart (Junior)
Ensign, U.S. Coast & Geodetic Survey, Department of Commerce, Washington 25, D.C. SEND MAIL: Coast & Geodetic Survey, 705 Federal Office Building, Seattle, Washington

LABIOSA, Victor M. (Associate)
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MARLOW, Joseph S. (Junior)
Metropolitan District Traffic Engineer, Michigan State Highway Department, 17405 Lahser Road, Detroit 19, Michigan. KEnwood 1-3500

MATYAS, Curt A. (Junior)
Associate Highway Engineer, California Division of Highways, 50 Higuera Street, San Luis Obispo, California, LIberty 3-6000. SEND MAIL: 320 North Tassajara Drive, San Luis Obispo, California

PRICE, Harry O. (Junior)
Traffic Operations Engineer, Wisconsin State Highway Commission, State Office Building, Madison 2, Wisconsin, ALpine 6-4411, Ext. 426. SEND MAIL: 1640 Sherman Avenue, Madison 4, Wisconsin

SHUFFLEBARGER, Curtis L., Jr. (Junior)
Highway Transport Research Engineer, U. S. Bureau of Public Roads, Washington 25, D.C., EXecutive 3-4950, Ext. 7452. SEND MAIL: 3600 Camfield Drive, Alexandria, Va.

Membership Applications

The Institute of Traffic Engineers welcomes applications from qualified traffic engineers, but does not desire as members persons who are unqualified. Listed below are the names of those from whom applications for membership or transfer in grade have been received since the last published list. Institute members are urged to review this as soon as possible and immediately inform the Executive Secretary's office if names of people are found who are known to be unqualified for ITE membership or transfer.

NEW APPLICATIONS

BERTOLINA, Charles J.
Planning Engineer, Research Department, Utah State Road Commission, 525 West 13th South, Salt Lake City, Utah. March 10, 1959 for ASSOCIATE grade

DARLOW, Arthur E.
Director, Department of Engineering, 3332 Pan American Drive, Miami 33, Florida. February 23, 1959 for MEMBER grade

DRUMMOND, Robert F.
Senior Traffic Engineer (Electrical), Boston Traffic Department, 112 Southampton Street, Boston, Massachusetts. March 9, 1959 for JUNIOR grade

FRISCHER, Donald
District Traffic Engineer, California Division of Highways, 120 South Spring Street, Los Angeles 12, California. March 9, 1959 for ASSOCIATE grade

LAUGHLIN, Francis J.
Senior Traffic Engineer, Boston Traffic Commission, 112 Southampton Street, Boston Massachusetts. March 9, 1959 for ASSOCIATE grade

MacNAUGHTON, Kevin A.
Assistant Civil Engineer, N. Y. S. Department of Public Works, 16th Floor, State Office Building, Albany, New York. February 26, 1959 for JUNIOR grade

NAVONE, Jack L.
Assistant Traffic Engineer, Alameda County Court House, 1225 Fallon Street, Oakland 12, California. March 5, 1959 for JUNIOR grade

O'CONNOR, Timothy J.
Traffic Commissioner, Boston Traffic Department, 112 Southampton Street, Boston, Massachusetts. February 18, 1959 for MEMBER grade

QUINN, Frederick M., Sr.
Senior Highway Analyst, New Jersey State Highway Department, 1035 Parkway Avenue, Trenton, New Jersey. February 25, 1959 for ASSOCIATE grade

SAMPSON, David B.
Highway Design Engineer, DeLeuw, Cather & Co. of Canada Ltd., 226 Sparks Street, Ottawa, Ontario, Canada. February 22, 1959 for JUNIOR grade

SMITH, Charles A., Jr.
Highway Project Planner, Port of New York Authority, 111 Eighth Avenue, New York 11, New York. February 18, 1959 for JUNIOR grade

APPLICATIONS FOR TRANSFER

BEACH, Frank C.
Assistant Planning Engineer, Wayne County Road Commission, 7th Floor, City-County Building, Detroit 26, Michigan. March 6, 1959 for ASSOCIATE grade

BRADLEY, John P.
City Traffic Engineer, City Hall, Colorado Springs, Colorado. February 27, 1959 for ASSOCIATE grade

CROCKETT, William R.
Associate Traffic Engineer, Wilbur Smith & Associates, 2215 Devine Street, Columbia, South Carolina. March 10, 1959 for ASSOCIATE grade

(Continued on page 55)

THE WASHINGTON MASS TRANSPORTATION STUDY

By William E. Finley

Director, National Capital Planning Commission,
Washington, D.C.

WITHIN A SHORT TIME, President Eisenhower will receive from the National Capital Planning Commission and Regional Planning Council, the long-awaited Mass Transportation Survey, as authorized by Congress in 1955. That report will recommend a combined transit and highway program to serve the needs of the 3,000,000 people expected to reside in the National Capital Area around 1980. If that population mark is achieved before that time, then the new transportation network will be needed before that time. The system recommended is an optimum one reflecting a level of service which in the opinion of the experts, the people of this region will need and be willing to pay for.

The report will be the result of the best thinking of dozens of people, ranging from the most technical of experts to the most realistic of politicians. The $450,000 spent on the survey was more than matched in value by the cooperation and participation of Federal agencies such as the Bureau of Public Roads, the Highway Departments and Public Utility Commissions of all three jurisdictions and planning agencies of the entire region. Continuing guidance has been provided by a steering committee headed by Commissioner Robert McLaughlin enhanced by the forceful leadership of Harland Bartholomew and General Welling. The major consultants were Wilbur Smith of New Haven; DeLeuw, Cather of Chicago, and Dr. Luther Gulick of New York, all men and firms of international status. In addition to them an even more renowned group of experts, such men as Donald Hyde of the Cleveland Transit System and Pyke Johnson of the Automotive Safety Foundation, reviewed every step of the work. The members of the Planning Commission and Regional Planning Council held dozens of meetings. Finally, the two men who more than anyone lived with this project day and night and deserve endless credit are Paul Watt now in the Metropolitan Government in Miami and Ken Hoover now chief engineer of the San Francisco Bay Area Rapid Transit Authority.

As a person who came into the picture very late in the game, I can tell you from my experience throughout the country that this study is the most advanced of its type in the United States, and I am amazed at how much has been accomplished for such a relatively small amount of money.

The study consisted of four phases: The first revolved around the principle that transportation is a function of land use, that there are no trips except those that are generated from use of land. This rather obivous fact has not been an accepted one among transportation planners for very many years. But its application is now relatively well refined although still somewhat complex. The first major job to be tackled was to prepare forecasts of future population and to decide where in the region this increased population would live and work. In cooperation with the planning offices in the area, all the alternatives of growth were studied. The General Development Plan for the region which resulted is a combination of what is likely to happen and what the planning commissions and local legislative bodies hope to see materialize. The General Development Plan does not portray necessarily the most desirable form of metropolitan growth. We think it is a realistic picture of this region in 1980.

The second phase had to do with traffic — with trips generated and their origins and destinations. How many people would go from this zone to that zone? How often and for what purpose? Studies of existing traffic movement were analyzed, basic assumptions were made, forecasts about income, automobile ownership, the workweek and leisure time were made, and the result was a network of future trip desire lines. These future travel patterns were tested by comparing them with those of 1955. Expert judgment and knowledge of travel behavior in other metropolitan regions were applied and a whole series of projections of traffic were made. So many thousand trips by auto, so many thousand trips by transit were spelled out by the traffic engineering consultants. This established the need for facilities.

The third stage involved the meeting of those needs. The product is a plan for moving traffic, the plan for moving people. To arrive at the final plan various alternatives were tested. The first was the complete use of the automobile with no metropolitan transit system, other than what we have today. It was soon determined that as many as 20 traffic lanes would be needed by 1980 in just one corridor, for example, running from the center of the District to the Wheaton area. This finding had many implications. Even if it were physically and financially possible to build those 20 lanes, what would be the loss in terms of housing, real estate values, and amenities, and once the cars reached the center of the city, where would they park? An even greater concern was that if 20 highway lanes were needed by 1980, what about after that? And, so while certain portions of the region can apparently be served primarily by highways in 1980, other areas will need carriers of greater capacity.

The second alternative was the use of busses only as transit vehicles operating on freeways. This system, too, fell short for many reasons. Busses have to compete with automobiles on the freeways. In many cases busses have to get on the local streets to deliver passengers. Busses require more operators than rail vehicles and the dumping of a thousand more busses on downtown streets during peak hours appeared to be more than the area could stand. Furthermore, an express bus line can only carry somewhat over half the passengers that a high-speed rail line can.

To complete the analysis, an all-rail system was tested. This system, of course, did not envision the complete abandonment of highway programs, since an amazingly large percentage of trips require the use of a private vehicle and such trips could not, under the assignment system, be counted on in the establishing of potential transit demand. However, the all-rail system could not be financially justified because large tracts of suburban land are occupied, or will be occupied at such

Adapted from a talk given by Mr. Finley at the Business Outlook Conference of the Washington Board of Trade, January 27, 1959—Ed.

a low population density that the expense of building and maintaining a rail line could not be met, at least not by 1980.

After many months of planning and measuring and making engineering studies, an unexpected conclusion emerged. It was, that this region, because of the nature of its development, not only would have to have the highway system previously planned, but in addition would have to have 65 more miles of freeways to meet the needs of automobile and truck traffic. The inescapable conclusion of months and months of study was that a transit system would save very little if anything on highways, but that it would make unnecessary the building of parallel highways in any one corridor and that the highway width would not in any single corridor have to exceed eight lanes.

The recommended plan, of which only the highway portion has been released, (to serve as the basis of decision-making by state, local and highway officials,) is a coordinated plan assigning to automobiles, busses and rail transit, those trips which each can best perform. The plan calls for 35 miles of high-speed rail, underground in portions, in open cut and in the center strips of highways. It calls for 70 miles of express bus routes on freeways, and a total freeway system 325 miles in length. It is likely that in some portions of the region when the total population exceeds 3,000,000 people that some routes could be converted from bus to rail.

The last phase, the one just finished, had to do with the organizations needed to implement the recommended plan. How to meet the complications of two states and the District of Columbia which the metropolitan area straddles. How to raise money to get the system on its way? What are the various sources of income to build the system? Can any transit system pay its own way for both operating costs and bonded indebtedness? These were the various questions answered finally by the steering committee, the Commission and Council, with the advice of the Institute of Public Administration.

That's the package and it will be delivered soon. But the question here today is what will be done in 1959? First the report will soon be handed to the President, and he is expected to transmit it immediately to the Congress for consideration. Senator Bible has said that his Joint Committee will hold hearings on it in the Spring. If the metropolitan community agrees with the findings of the study, if ample political support can be mustered, legislation will be introduced and the next steps can be taken. The Maryland Legislature and the Congress are now being asked to approve the Interstate Regulatory Compact already passed by the Virginia Legislature. This will be an important first step. This compact group, although its functions will be limited, can play a leadership role in keeping this project moving. The planners will attempt to explain and justify the plan. Community groups will study it. Business groups will find the analyses and projections contained in the report of great interest in their own planning. If everyone in the metropolitan community will support the steps proposed to carry out the plan, 1959 would see the Washington Metropolitan Area well on its way toward the finest transportation network in the Nation.

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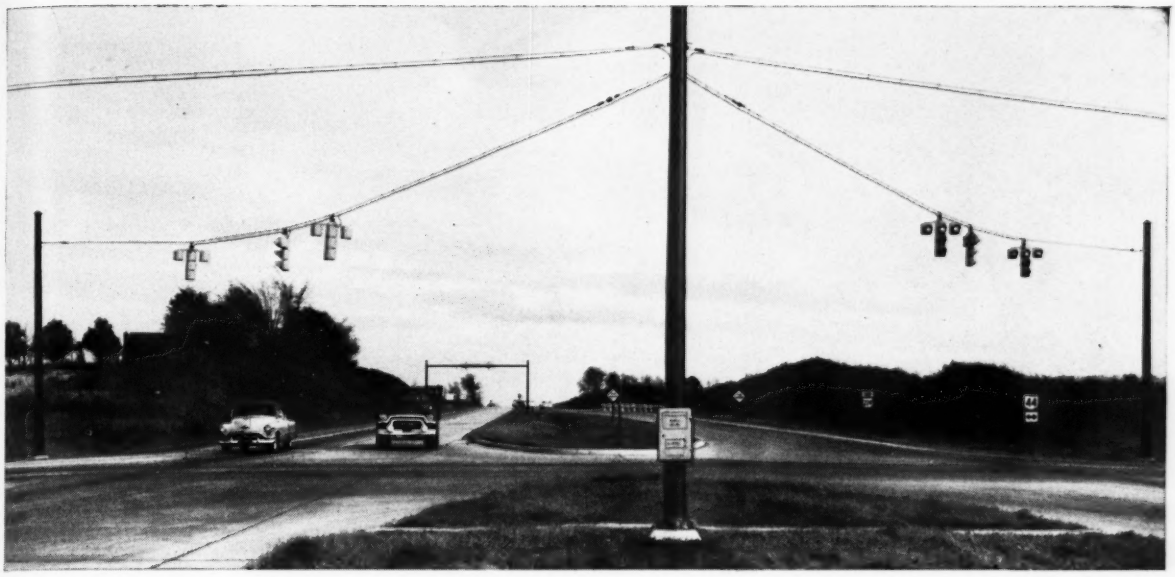

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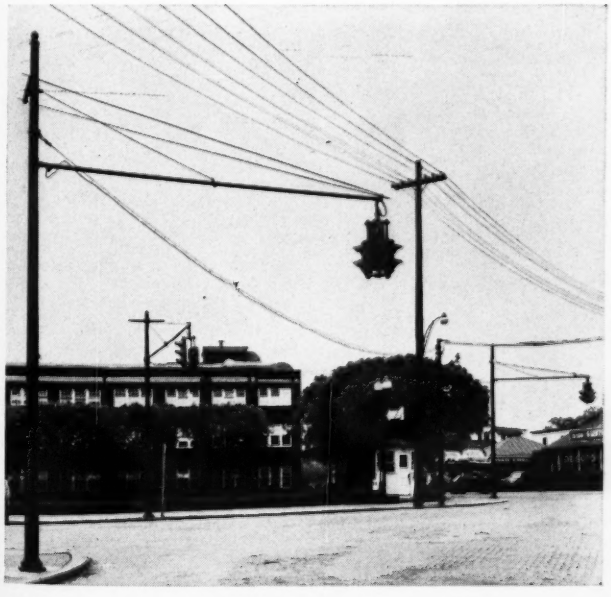

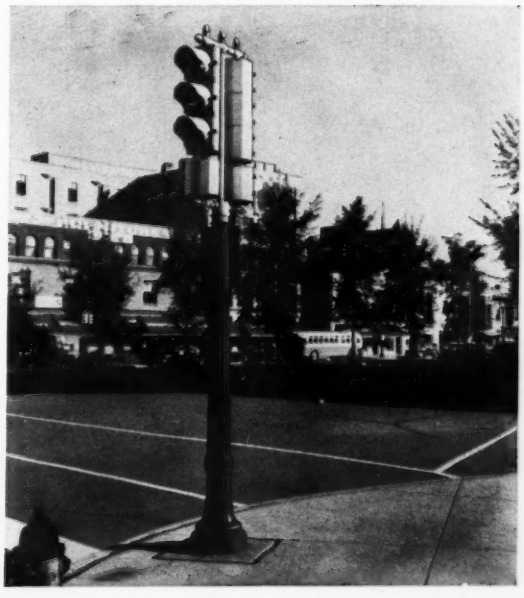

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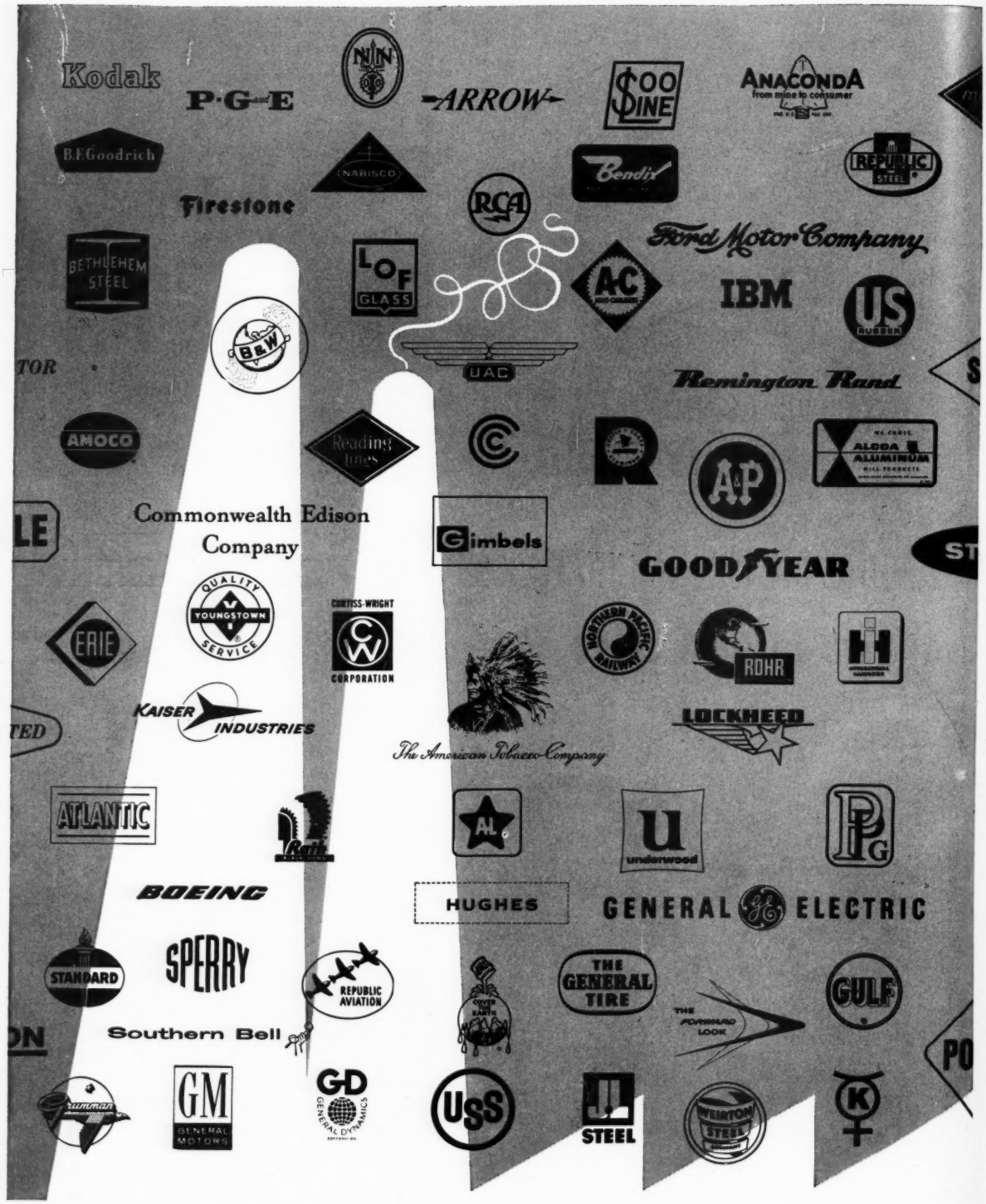

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These are but a few of the leading firms which support the Savings Bonds program with more payroll savers than ever before in peacetime.

Institute Affairs

TECHNICAL COUNCIL STANDING COMMITTEES 1959

Department No. 2
PROFESSIONAL STANDARDS, EDUCATION, TRAFFIC ADMINISTRATION AND STUDY TECHNIQUES

Carlton C. Robinson, Department Head
Hall, Edward M.
Kennedy, Norman
Marsh, Burton W.
Prisk, Charles W.
Webb, George M.

Department No. 3
TRAFFIC OPERATIONS MEASURES

Winston H. Carsten, Department Head
Klapproth, Walter H.
Maier, Eugene
Osborne, Henry W.
Porter, Harry, Jr.
Ristroph, Paul L.

Department No. 4
APPLICATION OF TRAFFIC CONTROL DEVICES

S. S. Taylor, Department Head
Bruce, John A.
Cass, Samuel
Harrison, Harry H.
Howie, George W.
Mitton, John H.

Department No. 5
PLANNING AND GEOMETRIC DESIGN OF TRAFFIC AND PEDESTRIAN WAYS

R. E. Dunn, Department Head
Buckley, J. Paul
Crandall, F. B.
Loutzenheiser, D. W.
Mitchell, Robert A.
Pepper, Allan R.

Department No. 6
PLANNING AND GEOMETRIC DESIGN OF TERMINAL FACILITIES

Edmund R. Ricker, Department Head
Bender, Louis E.
Bevins, Karl A.
Faustman, D. Jackson
Froelich, William R. B.
Goodwin, Charles A.

Department No. 7
DESIGN AND STANDARDS FOR DEVICES EQUIPMENT AND MATERIALS

Wayne N. Volk, Department Head
Barnes, Henry A.
Halsey, Maxwell N.
Lewis, Taylor D.
Mickle, D. Grant
Normann, O. K.

APPLICATIONS FOR TRANSFER

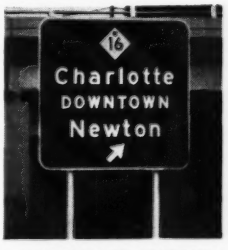
(Continued from page 50)

HARRISON, Russell E.
Assistant Engineer of Traffic & Safety, Wayne County Road Commission, 7th Floor, City-County Building, Detroit 26, Michigan. February 16, 1959 for MEMBER grade

KANSMAN, Sven
Traffic Engineer, Rader & Associates, 111 N. E. Second Avenue, Miami 32, Florida. January 14, 1959 for MEMBER grade

MUSICK, James V.
Chief Traffic Engineer, City, 67 North Front Street, Columbus 15, Ohio. March 6, 1959 for MEMBER grade

"Cuts maintenance to the bone"



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North Carolina's signs feature the approved reflectorized green background with white AGA letters. However, reflective material or painted backgrounds are available in any type letters or symbols.

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Irving J. Mack, Representative

Aluminum Company of America
Alcoa Building Pittsburgh 19, Pa.
R. G. St. John, Representative

American Transit Association
355 Lexington Ave. New York 17, N. Y.
George W. Anderson, Representative

Automatic Signal Division Eastern Industries, Inc.
Regent Street East Norwalk, Conn.
Paul L. Green, Representative

J. E. Bauer Company
1021 N. Mission Road, Los Angeles 33, Calif.
J. E. Bauer, Representative

California Metal Enameling Company
6904 East Slauson Ave. Los Angeles 22, Calif.
Standish K. Penton, Representative

Cataphote Corporation
2505 Albion St. Toledo 10, Ohio
Wm. J. Larkin (P.O. Box 2066, Jackson, Miss.) Representative

The Clinton Company
1210 Elston Avenue Chicago 22, Illinois
Richard H. Clinton, Representative

Eagle Signal Corporation
Moline Illinois
W. H. Peterson, Representative

Econolite Corporation
8900 Bellanca Ave. Los Angeles 45, Calif.
Aubrey Matthews, Representative

Flex-O-Lite Manufacturing Company
P.O. Box 3066 (Affton Br.) St. Louis, Mo.
Preston D. Law, Representative

General Electric Company
Outdoor Lighting Dept. Hendersonville, N. C.
W. E. Schwanhausser, Representative

Kerrigan Iron Works, Inc.
1033 Herman Street Nashville, Tennessee
E. W. Fitzgerald, Representative

Magee-Hale Park-O-Meter Company
Commerce Exch. Bldg., Oklahoma City 2, Okla.
G. A. Hale, Representative

The Marbelite Company, Inc.
175-179 N. 10th St. Brooklyn 11, N. Y.
William E. Lenz, Representative

Minnesota Mining and Mfg. Co.
900 Bush Avenue St. Paul 6, Minnesota
Donald O. Opstad, Representative

National Safety Engineers
P.O. Box 1069 Birmingham, Alabama
John E. Montgomery, Representative

Outdoor Advertising Association of America, Inc.
24 W. Erie St. Chicago 10, Illinois
Don Martin, Representative

Pfaff and Kendall
84 Foundry Street Newark 5, New Jersey
T. R. Skidmore, Representative

Prismo Safety Corporation
Huntingdon Pennsylvania
John C. Horn, Representative

Robbins Tire and Rubber Company
Tuscumbia Alabama
Ellis Webb, Representative

Southern Signals, Inc.
222 Beach Street Shreveport, Louisiana
J. Frank Williamson, Jr., Representative

The Streeter-Amet Company
Grayslake Illinois
George F. Graham, Representative

Union Metal Manufacturing Company
1432 Maple Avenue, N.E. Canton 5, Ohio
W. A. Porterfield, Representative

Veon Chemical Corporation
2209 Bridge Plaza N., Long Island City 1, N. Y.
Dwight T. Myers, Representative

Winko-Matic Signal Co.
P.O. Box 398 Lorain, Ohio
Irwin Hart, Representative

Section News

LOCAL SECTION MEETINGS

June 5, 6 & 7—Indiana, Michigan, and Ohio Sections (including Ontario) Pokagon State Park, Angola, Ind.
June 26 & 27 — Texas Section — Summer Meeting—El Paso, Texas
July 29, 30 & 31—Western Section—Annual Meeting — Benjamin Franklin Hotel, Seattle, Wash.

SOUTHERN SECTION

At the Annual Meeting of the Southern Section in Asheville, attended by 75 members and guests, the following new officers of the Section were elected:

President ..... Wm. S. Derrick
Vice President ..... Herman J. Hoose
Secretary-Treasurer ..... Marble J. Hensley

WESTERN SECTION

Sacramento Area

At the February meeting of the Sacramento Area, Western Section of Institute of Traffic Engineers, Charles E. Zell spoke on his recent European tour. Mr. Zell visited the Danish Highway Department in Copenhagen and the Holland Highway Department at The Hague. Among the things he discussed with them was the uniformity of traffic control devices. In each of these countries a single agency has the authority to set standards and see that uniformity of devices is carried out throughout the country.

Dee McKenzie has been promoted from Traffic Engineer to Highway Engineer in charge of the design division for the Sacramento County Highway Department. Dee is a registered engineer and was the County's first traffic engineer. Incidentally, his old job is open and any interested parties should contact the Sacramento County Personnel Office. The job calls for a registered engineer ($750-$850), but it is understood that they will accept applications from those who aren't registered and if accepted the salary would be at a lower scale.

Mel West spoke on the California Freeway System at the ASCE meeting in Los Angeles. This system is a state-wide basic plan of a freeway network to connect all major civic, recreational, agricultural, and industrial centers of California — a very sound and practical approach.

Oregon Area

The last Area meeting held in Portland drew two carloads of Washington Area members and three fellows from Lane County. Among those from Washington was Western Section President, Bob Dunn. Robert C. Blensly was speaker for the evening and presented a study on "Vehicle Placement on Rural Highways." A discussion on the proposed redivision of the ITE Districts followed Bob's presentation. J. Al. Head, Director of District 6, started this discussion, followed by Bob Dunn, Western Section President, and Glen Clark, Oregon Area Co-Chairman. This was a new subject to most of the membership and drew many questions. It was decided that a poll through the WesternITE would be a good idea to learn the feelings of the members.

San Diego Area

The San Diego Area dinner meeting held at the LaFayette Hotel on Friday evening, February 13th, was well attended by members and guests from the Los Angeles and San Diego Areas. Alan Voorhees of the Automotive Safety Foundation was the honored guest. Chairman Ed Hall introduced Clarence Walcott and ITE'R Bill Calland as guest speakers. They presented a very informative evening on "The Planning and Operation of Construction Detours." The uncontrollable urge to be heard was noted in the issuance of a statement by Jack Henberger "that *some kind* of high level warning device was needed for construction areas."

Along with the Division of Highways, local cities and the county are feeling the results of the entire length of US80 through Mission Valley being under construction. The task of handling 55,000 vehicles daily through this construction is being felt by all jurisdictions.

Work has begun on the controversial Torrey Pines Road project in San Diego's LaJolla Area. The one-mile section of narrow, winding two-lane road will be replaced with a four-lane divided highway, 82 feet between curbs. Left turn pockets, two signalized intersections, and safety lighting will make it one of San Diego's notable street improvements. The project was delayed over five years due to disagreements between engineers and property owners concerning design and route.

Jim Reading announces a new addition to his City of San Diego Traffic Engineering Staff. Welcome to Benjamin Geerds, Junior Traffic Engineer, who hails from Michigan.

San Diego traffic engineers and public works crews inaugurated use of the new traffic work order forms and manual, effective February 1, 1959. The entire system is designed for and adaptable to machine records processing. Man, what confusion. It's the only reasonable explanation for that recent well-publicized goof made in painting a city street. Seems that in San Diego they have "Pots Ahead."

Marty Bouman was installed on January 30 as President of the San Diego Municipal Employees Association. Highlights of the evening were talks by Mayor Charles Dail and City Manager, George Bean, who was also installing officer. After appropriate promises, Marty clowned it up by awarding the outgoing President his gold-plated gavel which was stirringly inscribed "Made in Japan."

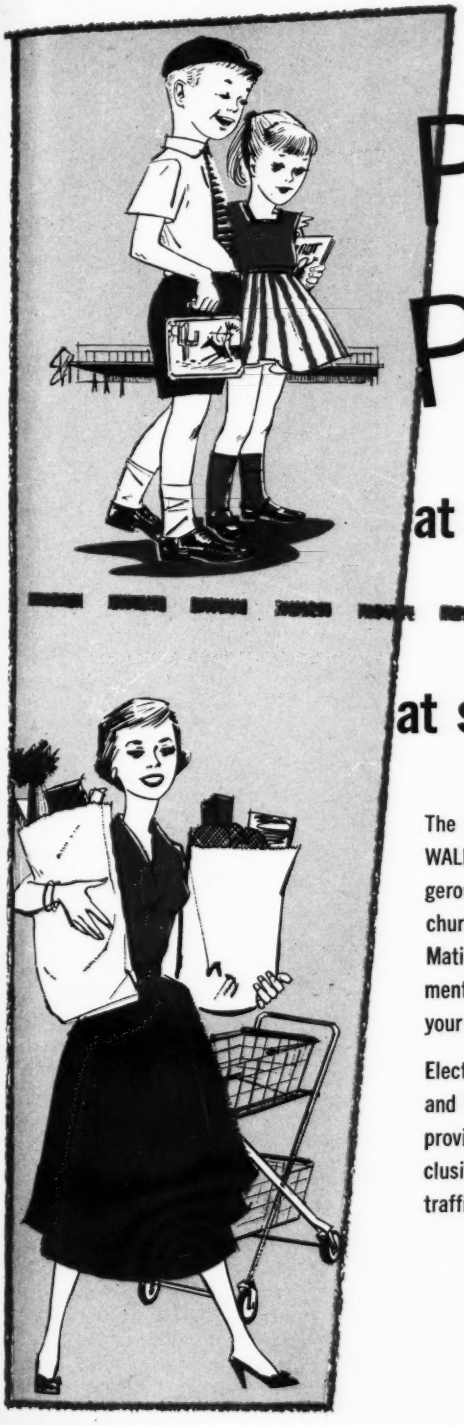
The City of San Diego announces completion of million dollar widening projects on Washington Street and El Cajon Boulevard. Traffic congestion has been rendered far more orderly as a result.

Los Angeles Area

The proposed $149,000,000 bond issue for street and highway improvements being considered for the City of Los Angeles includes $10,000,000 for traffic signal work.

Now that it is certain the Los Angeles Dodgers will play at least one more season in the Coliseum, study is being again given the problem arising from the impact of game traffic on surrounding streets already loaded to capacity by afternoon peak hour traffic.

Problems connected with freeway con-



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struction within the Los Angeles Area continue to multiply as Federal funds accelerate this type of work. With every new contract let surface street traffic is dislocated by construction. Temporary terminus problems exist at the end of every new portion of freeway where traffic is forced to re-enter the existing city streets. It certainly is worth all of these inconveniences, however, when the freeway is in full operation and surface streets return to normal with reduced traffic volumes.

Los Angeles City is beginning a program of freeway approach directional signing. The first unit of this program will sign approaches to the Hollywood Freeway in the Hollywood area. This first unit includes 22 roadside signs and 8 signs to be mounted over the roadways. It is planned that all approaches will eventually be improved by this program.

C. M. Gillis, County Road Commissioner, and Guy McDonald, County Traffic Engineer were ITE representatives of the County Road Department to the recent ITTE Conference in Berkeley, California. Also from the County Road Department were potential ITE members, N. H. Templin and George Fairbanks.

Several ITE members from the County Road Department attended the ASCE Convention at the Statler Hilton recently. Among the speakers were George Webb, Dolph May, and Alan Voorhees.

Inter-Mountain Area

"Denver Hosts 1962-National ITE Convention." This was the main topic of discussion at the Inter-Mountain Area Meeting in Colorado Springs on January 30. Reports by Chairman Pepper and his Committee Members, Bruce and Shockey, indicated that Denver was the logical site for the 1962 Convention. The feeling was substantiated by all of those in attendance, and a unanimous resolution was passed directing the Committee to proceed towards this end. From the comments we received in Denver following the Section Convention in 1957, we are sure that this will meet with very favorable consideration by all of you. The band wagon has started to roll, and we look for all of the Western Section to jump on and root for Denver for 1962!

The meeting in Colorado Springs was another successful meeting, much enjoyed by all in attendance. There were 11 members and 12 guests attending the meeting.

Prior to the formal meeting, most of the group toured the Air Force Academy, and had an opportunity to view the progress there. This is a real step forward in the education of our military leaders, and should provide a wonderful field trip during the '62 Convention. The business portion of the meeting generally followed the pattern which John Bradley intitiated last year, of comments by the various groups in attendance as to what changes and developments had taken place during the last year. John Bradley commented on a few of the "first" or "near firsts" which have occurred in Colorado Springs. It seems that this was one of the first cities to introduce the "YIELD" and red "STOP" signs. Also, they appear to be about the only city to have opened a one-way reciprocal street system and still retain angle parking on the street. John then continued with a short resume of the impact of the Interstate Route on the Colorado communities, and described in particular the routing of the Interstate Highway through Colorado Springs. Another major change in the Colorado Springs Area has been the recent change over to a double alternate system of signal control in the downtown district. Jim Small, Denver's Acting Director of Planning, then gave us a brief resume of the forthcoming Metropolitan Transportation Study and also commented briefly on the Planning Office's plans which they are preparing for the Metropolitan Area for 2000 A.D. Gus Byrom advised us that Aurora is contemplating changing many of their school signals to the pedestrian actuated type. For its size, Englewood seems to have performed more work than any other city in the area this past year. Joe Lacy told us that more signs were installed in Englewood in 1958 than all signs previously existing in this city. 1958 also marked the beginning of actuated signalization for Englewood. Next year their plan is to redesign all of their signing around the schools, and they also hope to initiate an accelerated paint striping program. Future plans also call for modification of their signal system and the addition of a second three-high, four-way signal at each of the existing locations which now contain only one four-way indication. Englewood also plans to install its first one-way system this summer.

Jack Bruce then commented on the recent past and the forthcoming program for Denver with the opening of the latest one-way street systems and the opening of the Valley Highway in its entirety. He commented about the problems arising from slow drivers on the Valley Highway, something most of you Californians are very much aware of. Other remarks concerned the forthcoming court action on the proposed 48th Avenue Freeway, and the Colorado Boulevard widening relative to use of Parkland for freeway and highway purposes. This has certainly been a hot issue here, and seems destined to go on in the courts for quite some time. Changes for the future involve the reworking of certain underground feeds in the Central Business District, a modification of the pedestrian phase in the Central Business District to permit the pedestrian movement along protected crosswalks, at the same time that certain vehicular traffic is moving, and the proposed radio interconnection of our outlying traffic signal system to better coordinate the progression throughout the entire city. Last, but not least, Al Pepper reported on the progress of the Traffic Operations Section of the Colorado Department of Highways. It seems that their office has been playing a greater role in the Department as far as construction and engineering services are concerned with their design of signing for the Interstate System. This signing has met with such favor throughout the State that demand is forcing them to expand the use of this signing to several non-Interstate Highways. Al also commented on possible action by the legislature this year to increase the speed limit to 70 miles per hour. In this respect, the Section is now studying vehicle speeds on selected sections of four-lane highways having full or partial control of access. The contract for signing of traffic controls on the construction projects and the Interstate sign contract for the Pueblo Area is soon to be let.

MID-ATLANTIC SECTION

The Annual Meeting of the section was held in Harrisburg on November 21, with 45 members and affiliates present. Elected officers for the coming year were:

President ..... Richard A. Overmyer
Vice President ..... Armand E. Keeley
Secretary-Treasurer ..... Hartley C. Gafvert
Director ..... Wm. R. B. Froelich

Member News

Bill Miller passes on the information that the Superior Court of Delaware has upheld the Highway Department's authority to construct Interstate Route 95 through Wilmington, after this question was raised in a taxpayer's suit against the State. At this time right-of-way is being acquired, and over 50 per cent of the property owners have requested appraisals.

Bill Carrow enjoyed a week of school on Traffic Safety Management in New York last month, and was accompanied by J. James Ashton, Manager of the Delaware Safety Council.

The Delaware State Highway Dept. was represented at the Highway Research Board by Stu Cunningham, Traffic Engineer, and David Witheford, Planning Engineer, who managed to spend a day or so at the Highway Research Board, "gathering information and comparing notes with fellow traffic engineers." In fact, quite a few of the Section members were present (comparing notes, etc.), including Hank Osborne, who spent some time interviewing a minister.

Dave Witheford reports that he is sweating out initial public reaction to the new edition of the Official Highway Map of Delaware, and that he would be glad to send copies to anyone interested.

Congratulations are in order for Bill Froehlich, Executive Director of the Public Parking Authority of Pittsburgh since 1952, who has joined Governor Lawrence's administration in the capacity of Chief Deputy Secretary of Highways. Bill did a great job for the City of Pittsburgh, and we're sure that he will do the same for the State of Pennsylvania. Merritt Neale, Bill's former assistant, will move to the top position in the Parking Authority. We wish them both well in their new ventures.

The Bureau of Traffic Planning of the City of Pittsburgh is conducting its business under trying circumstances these days. Additional space was obtained from the 'city fathers' so that there was a shift in offices for the traffic personnel. Besides moving the office furniture, the painters, electricians, and telephone men moved in to pretty up the place, so that the end result was a good state of confusion. The Bureau should be back into full production by Spring.

New roadway construction in the downtown area of Pittsburgh continues to plague Mike Gittens, Woody, and Tony, with every detour or ramp providing new problems in signs, signals, barricades, etc.

Our Pittsburgh Newsletter correspondent reports that he saw Don McNeil the other day but didn't even get a chance to say hello —he was running, as usual.

Bill Canning has been on the go so much that he hasn't been spending much time in his office, and as a result Mose Egly appears to be getting super-efficient. He is writing two reports at the same time, on two unrelated subjects. Sounds as though he's using the same text for both.

Bob Hoffman is recovering from the trials and tribulations of a seminar on "Safety for Driver Education Personnel." He wants to call attention to the booklet, available from the various local AAA headquarters on "Planned Pedestrian Control." He is busily engaged in a project to reactivate a defunct committee whose prime function was having lunch together and also planning Philadelphia meetings or something.

Bill Canning and Jack Miller engaged in some unusual traffic planning to start the year off right. Since Bill was to be in Washington at the H.R.B. meeting he was asked to check on some information for Jack, who was to be at a meeting in Harrisburg and, therefore, couldn't be in Washington. It all ended up with Miller in Washington looking for Canning, while Bill was in Harrisburg looking for Jack.

Gene Simm, Traffic Engineer for the City of Harrisburg, was in Washington, D.C. March 4, at the Annual Eastern Meeting of the National Transit Association. He addressed the group on the subject of "Harrisburg's Traffic Control Concept."

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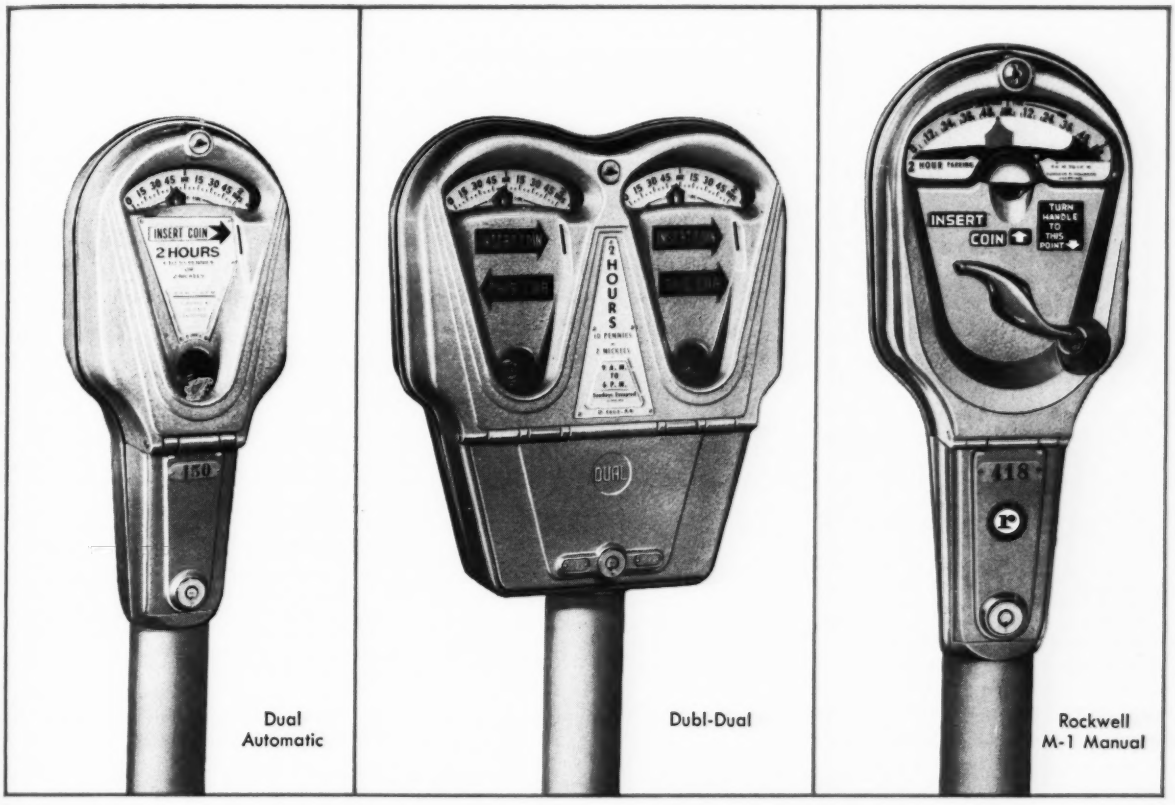

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Requirements: Engineer with graduate training in traffic engineering and a minimum of three years of traffic experience.

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SIGNAL MAINTENANCE

(Continued from page 46)

required at their finger tips. Also, since a driver must be added to those doing signal work, the proportion of those doing productive work is higher than where only one can reach the signal.

We are doing a vastly improved job of signal maintenance with brighter signals and fewer burnouts, and with much less labor than formerly. Lamp cost has naturally increased but is far more than offset by the plus factors mentioned.

We are quite pleased wtih our signal maintenance program after the long process we have gone through in coming to it.

Following is a summary of conclusions formed from the questionnaires returned.

1. A majority are now using group replacement and are enthusiastic about the saving in labor and trouble calls.

2. A number still using individual replacement either are not satisfied with their maintenance or are about to turn to group replacement.

3. A small minority are firmly of the opinion that individual replacement is more economical.

4. Only one city (San Diego) offered detailed costs of lamping. These were unit costs for individual relamping, for group relamping, and for cleaning. Costs are as follows:

I.R.	
Labor 0.6 man hours	$1.60
Material	.22
Equipment rental	.43
	$2.25

G.R.	
Labor .12 hrs.	$ .32
Material	.22
Equipment rental	.07
	$0.61

Unit cost under G.R. includes costs of individually relamping early burnouts. Unit cost of cleaning (where cleaning is done with relamping) is:

Labor .06 hrs.	$0.15
Equipment rental	.01
	$0.16

5. There is a rather wide range of intervals used for group relamping with most using a constant interval for all intersections.

6. A small number doing group relamping use an interval which varies from intersection to intersection depending on life of lamps at each intersection. (This may vary from 6 to 24 mos.)

7. Group relamping is systematically linked with cleaning at the same time.

8. Even where individual relamping is done, most cities have a scheduled cleaning interval.

9. Where signals are not corner post signals, a few cities are using hydraulic tower trucks, on which two men have good freedom of movement, but most cities as yet are using the conventional aerial ladder.

10. A small proportion of cities contract their lamping and cleaning. The great majority do it themselves, making it very important in the face of limited manpower to adopt that method which is most economical in the use of manpower.

SPEED LIMITS

(Continued from page 24)

In view of the foregoing considerations, namely, that

(1) numerical limits are not satisfactory because of variations in driving conditions; and

(2) even if they were satisfactory, drivers, as a rule, pay no attention to them;

it would appear that logic would dictate the removal of all speed signs. However, if all speed signs were removed, a police officer would be left to his own devices to determine whether a driver was driving at a reasonable and prudent speed and a conviction for speeding would be difficult to make even though the accused might have been driving at a very excessive rate.

Posted speed limits then can serve a useful purpose if set sufficiently high to separate the large majority of alert and careful drivers from the few flagrant violators of traffic regulations.

The 85 or 90 percentile speed seems to be the logical speed at which to set the speed limit for any given section of road.

Conclusions

The following conclusions appear justified on the basis of the data:

1. Under otherwise similar conditions, traffic flows at slightly lower speed (about 1 mph slower) at night than during the day on arterial streets in Nashville.

2. On Nashville arterials under otherwise similar conditions the average speed of vehicles is lower (about 2 mph) during the peak hours than during the offpeak even without severe congestion.

3. During peak traffic hours vehicles travel at more uniform speed than during offpeak hours.

4. Posted speed limits in Nashville have little, if any, significant effect on traffic speeds, regardless of whether the posted limit is set at even multiples of 5 mph or not.

5. A single overall speed limit for the City of Nashville is unsatisfactory and unrealistic because of the wide difference in driving conditions on different streets in different sections of the city.

6. Posted speed limits set at the 85 or 90 percentile speed would serve a useful purpose in providing the police with a guide as to what is the maximum speed which can be considered reasonable and prudent.

Recommendations for Nashville

On the basis of this study, general recommendations for Nashville were made as follows:

1. That the Traffic Engineer be authorized to make a speed study of prevailing speeds on the major arterial streets of Nashville and from this study to make recommendations for appropriate speed limits for each major street or section of major street.

2. That speed limits be set at even multiples of 5 mph.

3. That the existing speed limit of 30 mph remain on any streets not studied by the Traffic Engineer.

POSITIONS AVAILABLE

(Continued from page 60)

Salary: $8,000 annually, with one month vacation, and 5 per cent annual increases in salary.

Apply: Alfred L. Moseley, Department of Legal Medicine, Harvard Medical School, Boston 15, Massachusetts.

TUCSON, ARIZONA

Position: Assistant Traffic Engineer.

Requirements: Four years of experience or college training in engineering, including some experience or training in highway or traffic engineering.

Salary Range: $420-$500 per month.

Apply: Civil Service Commission, City Hall, Tucson, Arizona.

SPRINGFIELD, MISSOURI

Position: Chief, Traffic Engineering.

Requirements: College degree in engineering or equivalent with specialization in traffic engineering. Desire a minimum of two years' responsible experience directly in traffic engineering. Will head Division of Traffic in Department of Planning and Traffic.

Salary: Salary open.

Apply: Granville Willoughby, Director of Personnel, City Hall, Springfield, Mo.

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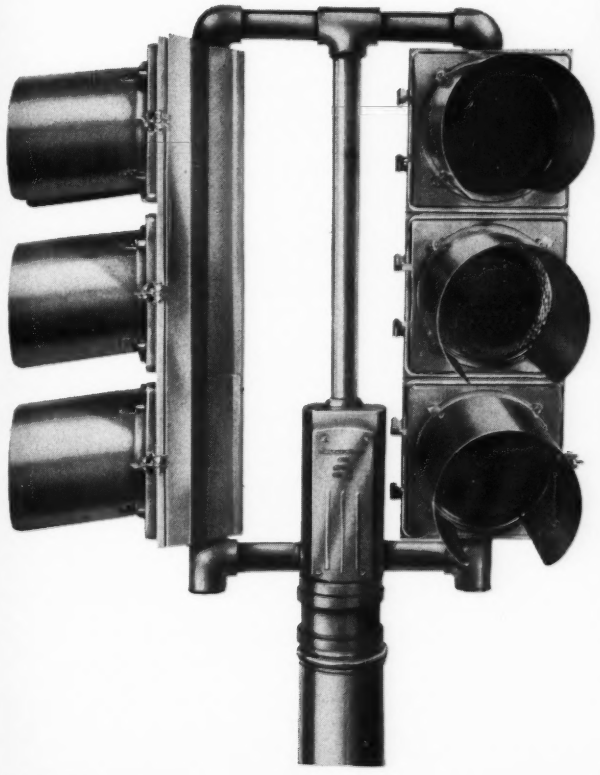

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